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DENTAL HEALTH STATUS OF THE NEW ZEALAND
POPULATION IN LATE ADOLESCENCE AND
YOUNG ADULTHOOD

Issued by the National Health Statistics Centre

Department of Health, Wellington.



1968

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DEPARTMENT OF HEALTH

DENTAL HEALTH STATUS OF THE NEW ZEALAND POPULATION IN LATE ADOLESCENCE AND YOUNG ADULTHOOD

A Survey Conducted by the Dental Health Division
of the Department of Health

compiled by
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SPECIAL REPORT No. 29

*Issued by the National Health Statistics Centre
Department of Health, Wellington
1968*

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The opinions expressed in this report
are those of the author and do not
necessarily represent the views of
the Department of Health

FOREWORD

This report relates to an extensive survey which was initiated in 1962 by the Division of Dental Health. It was undertaken by the former research officer of the Division, who resigned from the Department of Health on completing the field work to take up an appointment at the University of Otago Dental School.

As the title of the report indicates, the principal purpose of this survey was to determine the standard of dental health of the adolescents and young adults of New Zealand and by this means to evaluate the country's public dental health programme.

It is very encouraging to find that the results which are being achieved by providing organised dental services to the youth of New Zealand up to 16 years of age free of direct cost to their parents are proving remarkably good. The report shows that a large proportion of adolescents continues to attend a dentist after free treatment ceases, indicating that they realise the importance of sound dental health and value the services they have previously received.

In view of the comparative lack of information on this particular aspect of dental health I am sure that this report will find wide interest, not only with dentists but with all who are engaged in the field of public health.



D.P. KENNEDY

Director-General of Health

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DENTAL HEALTH STATUS OF THE NEW ZEALAND POPULATION
IN LATE ADOLESCENCE AND YOUNG ADULTHOOD

SECTION 1 : INTRODUCTION

1.1 Initiation of the Survey

In common with all other countries, there is in New Zealand a paucity of information regarding dental epidemiology in adults. The reason for this is quite straightforward. The problems associated with sampling from an adult population and obtaining access to and permission for a dental examination are very great indeed. No such problems exist with children where schools provide an excellent sample frame, and at the same time, a convenient location for dental examination. It is not surprising that information on dental disease prevalence is readily available for children but almost unknown for adults. The United States Public Health Service has over the last few years attempted to fill this gap for their country by the use of an itinerant survey team (1,2) working in large trailers and sampling from the total US population but this has been the first serious attempt at this type of epidemiological work over the complete age range.

The Division of Dental Health of the New Zealand Department of Health became actively engaged in this area of research in 1962. There were two main reasons for this. First, the survey that was initiated then represented an evaluation of the country's public health dental programme for children - an evaluation the need for which had been realized by the Division for some years. The basic matter for investigation was this: what is the state of dental health and dental fitness in the late teen-age years? New Zealand has for many years supported out of taxation the routine dental care for children aged 2½ to 15 years; on the sixteenth birthday the individual becomes responsible for his or her own dental bills. Does this change in the economics of dental care at age 16 produce any change in the standards of dental fitness through a change in the regularity of dental treatment? This is probably the most important question in dental epidemiology in New Zealand today. Under the particular system of public health dentistry which has been successfully developed in this country over the years, a high standard of dental fitness has been achieved in childhood and in adolescence. The question was: how permanent were these results? Does the individual assume responsibility when the State ceases to provide dental benefits? These questions were certainly ones which required an answer. Continual evaluation of the results achieved in a public health dental programme is an essential part of any well-designed programme and the need for this particular form of evaluation was certainly present to a marked degree. The second main reason that allowed the Division of Dental Health to undertake this survey was that the establishment of head office had been increased in 1961 by the addition of a full-time epidemiological research officer, the Principal Dental Officer (Research) and so the Division was now in a position to undertake research of this type.

The resulting survey designed to establish the dental fitness of the products of New Zealand's public dental health programmes, i.e., the

population aged 16 to 21 years, is the subject of this report.

1.2 Aims of the Survey

The aims of this survey were four-fold:

- (a) The investigation of age-sex specific caries prevalence in the 15 to 21 year old New Zealand population. (Fifteen year olds, still eligible under General Dental Benefits to participate in the public health dental programme, were included to give a basis of comparison with the older subjects who were not eligible to participate.)
- (b) The investigation of the amount of dental treatment this age group is currently receiving in New Zealand.
- (c) The investigation of the amount and nature of dental treatment currently required by this age group. This included an investigation of treatment needs in the fields of conservative dentistry, periodontia, prosthetic dentistry and oral surgery.
- (d) The investigation of various minor facets of the dental condition of this age group such as enamel opacity, enamel hypoplasia and standards of oral hygiene.

SECTION 2 : METHODS

2.1 Sampling

Virtually every epidemiological survey conducted in the past has fallen into one of the following broad categories:

- (a) A survey which drew its subjects from educational or institutional groups;
- (b) A survey among the patients of a private dentist, a group of private dentists, a dental treatment institution or dental school;
- (c) A survey which involved the total enumeration of a closed population such as that of a small geographic area or small island;
- (d) A survey among a relatively primitive population in which there appeared to be little variation (a) in the prevalence of dental disease and (b) in the availability of dental treatment.

All such surveys had the following two characteristics in common. First, the sampling problems were minimal. Either the population was totally enumerated - in other words there was no sampling - or, by applying relatively simple sampling criteria, a representative sample was obtained. The latter is best exemplified in common school-child surveys. Second, such surveys could not answer the question: "what is the prevalence of dental disease and the need for dental treatment among an adult population living in an environment of modern western civilization?"

The reason why surveys which would answer this question are only now being tackled is obvious. A survey of an adult population in a national environment such as our own in New Zealand demands the examination of a representative cross-section, and the location of subjects must necessarily be arduous, time-consuming and costly.

The means by which a representative sample of an adult population might be obtained are three:

- (a) By the selection, by a suitable randomizing procedure, of individuals from a complete listing of the population such as the electoral rolls.
- (b) By the utilization of the so-called Household Area-Unit Sample. Under this system the entire country is divided into blocks containing twenty-five households. A random selection is made of these blocks, subject to any stratification desired such as a subdivision into urban and rural blocks. All individuals living in the selected blocks would then be examined to form the sample. This is the system being used in the extensive US Public Health Service survey (1,2).
- (c) A sampling method based on places of employment or other day-time activity.

The first two of these methods, while they would both result in ideally representative samples of the population, are very cumbersome and expensive for dental survey purposes. The location of sufficient subjects from electoral rolls or other individual selection method is very difficult. This method lends itself to surveys of many types, particularly those which rely on mailed or telephoned questionnaires. However, actually to find the individuals in person and give them a dental

examination poses many organisational problems. The household area-unit sample system is ideal for the type of survey where a survey official calls on houses with a questionnaire that any member of the household who happens to be home can answer on behalf of the whole household. But for a dental survey where each member of the household would have to be seen individually and given a dental examination, the system would be very difficult to administer.

The first two schemes were therefore rejected leaving only the third, the scheme that utilized places of employment as the basic unit from which sampling was made. This scheme at least had the merit that when the survey team set up their dental equipment at the place of business, they could be reasonably well assured that they would obtain several subjects within a short space of time and that therefore the whole survey could be completed with considerably less expenditure of time and effort than that demanded by the first two methods.

The decision to conduct a survey examining the dental status of the population in the years immediately following release from the General Dental Benefits scheme stimulated these concepts of sampling and provided an opportunity for their trial. The sample, being late teen-agers and in their early twenties, provided an intermediate group between school children and true adults. Because a considerable proportion of the 15 to 21 year old population is no longer at educational institutions but in employment, the traditional school-child sampling method could obviously not be used.

Following the reasoning described above, it was decided that sampling based on places of employment or education offered the most satisfactory method of conducting a survey on this age group.

From the 1956 Census, the 15 to 21 year old New Zealand population was categorized into the following seven strata:

- (a) Persons in private employment
- (b) Self employed persons
- (c) Employees of government departments and local bodies
- (d) Members of the armed forces
- (e) Persons in educational institutions
- (f) Persons engaged in farming
- (g) Housewives and unemployed persons

The ratio of the male population and the female population falling in each category was then determined. These ratios were applied to the known total survey sample required - 1000 males and 1000 females - in order to deduce the numbers of male representatives and the numbers of female representatives of each category that should appear in the sample. By this method the sample goals shown in Table 1 were calculated. This table shows the numbers of males and of females required in each category to make up the sample of 2000. The largest categories were Private Employment and the Educational group.

Because of varying circumstances in each of these seven categories different sample frames had to be established within each category. The sample frames were so designed that a sufficiently representative sample would be obtained while at the same time a survey method that did not call for impossible expenditure of time by the survey team was established. These seven sample frames are described below, commencing with category (b).

Category (b) - Self Employment: This group was so small and the representatives so difficult to locate that it was ignored. These 44 individuals were pooled with Category (a), Private Employment, which was thereby enlarged to 1008. This compromise in sampling was justified by the small numbers involved and by the assumption, probably warranted, that there was no reason to believe that any significant differences would occur in the dental status of those of this age group in private employment and those in business for themselves.

Category (a) - Private Employment: One hundred and twenty-four firms (factories, offices, stores etc.) throughout New Zealand, listed in Appendix One to this report, were selected by the following randomizing procedure. A virtually complete, numbered listing of all firms in New Zealand was provided in the publication "The New Zealand Business Who's Who". (3) Using the numbering provided in this listing, 124 firms were selected by use of a table of random numbers.(4) In the interests of practicality any firm selected by the randomizing procedure that had a total staff of less than 20 was excluded. It was probably a justifiable assumption that the staff in these deleted firms did not differ significantly, in a dental sense, from the staff in the included firms. One hundred and two of the selected firms, listed in Appendix One, were actually included. The remaining 22 firms were excluded for reasons given in Appendix One. In the firms visited the 15 to 21 year old staff was completely enumerated within the limitations of the subject response level. This was found to be surprisingly high. In the entire survey there were only two or three definite refusals to participate by prospective subjects. There could perhaps have been some few more unknown to the survey team: in some organizations the approach to the employees was made by the management rather than by the survey team. However, in these cases the importance of response level was stressed to the management beforehand and this in many cases resulted in the approach to the staff being in the form of an instruction rather than a request. One aspect of the response that needed to be constantly watched concerned the edentulous subject. Very early in the survey it was noted that there was a tendency for the edentulous subject and his employer to think that he would not be required for the survey because he had no teeth. Throughout the remainder of the survey employers were specifically told during the preliminary interview that this was not so and that the team would like to see all under-22 employees whether they had their own teeth or not.

Despite efforts to correct it, there appeared to be some confusion in the minds of the managements about whether the survey involved those who were aged 21 years and under or those who were under 21. This is probably the reason for the quite small sample sizes obtained in the 21 year old groups.

The original survey design called for the exclusion of any selected firms which had not been visited at the time the required sample size was obtained. In fact, four firms (Appendix One) were excluded for this reason.

Category (c) - Government Departments and Local Bodies: Six government departmental offices and one local body (Appendix One) were selected by a simple random sample method. The examination of the 15 to 21 year old staff in four of these offices produced the required sample size.

Category (d) - Armed Forces: The category was so relatively small - a total of only 24 subjects - that one armed forces establishment (Appendix One) was selected as being sufficiently typical of all armed forces establishments. The subjects were selected by a randomizing procedure from the list of personnel in camp at the time.

Category (e) - Educational: This category was subdivided into the following sub-categories:

- (i) High schools
- (ii) Universities
- (iii) Teachers' Colleges
- (iv) Nurse Training Hospitals
- (v) Other

Five high schools, one university, one teachers' college, three teaching hospitals and the Police Training School (Appendix One) were purposively selected to give representatives from all five sub-categories and a broad geographic cover. In the case of high schools selection was also made to include both urban and rural groups and professional and technical groups. Within each of these institutions the random selection of subjects was quite straightforward.

Category (f) - Farming: This category posed the greatest challenge in sampling and it was in this category that the greatest compromises had to be made. Among the approaches that were considered and rejected were:

- (i) Calling at farmhouses at random in the hope of locating 15 to 21 year old subjects. This was attempted in the pilot study to the present survey. Calling at eight farmhouses resulted in the location of one subject, the radiographic examination of whom would have required, by an unhappy chance, a 230 volt extension cable about a quarter of a mile long. To have tried to locate 174 subjects by this means would obviously have been quite impractical.
- (ii) An approach through such organizations as the Young Farmers' Clubs would have produced a biased sample. Membership of such clubs would not appeal to all types of young people employed on the land.
- (iii) Drawing subjects off the streets in a market town on market day. The organizational problems would have been very considerable.
- (iv) Drawing the sample from the student body at the agricultural colleges. The type of young man doing a degree course in agriculture could not be regarded as typical of all young people working on the land.
- (v) Examining patients of rural dentists. This method had to be rejected. A survey designed to provide information applicable to the entire population must include both those who attend dentists and those who do not.

The only satisfactory technique that could be found - and the technique that was eventually used - drew subjects from two sources:

- (i) New Zealand Forestry Service Woodsmen Training Schools. These training schools, one in the Kaingaroa State Forest in the North Island and the other in Golden Downs State Forest in the South Island, provided subjects that were considered to be in a similar environment, dentally, to farm workers; they lived in a rural area and could obtain dental treatment only by travelling a considerable distance into town. They formed a group which was readily available for examination. Being drawn from all over the country they provided a broad geographic cover. They were

considered to be in a similar environment economically to the average young farm worker.

- (ii) The Department of Agriculture's training establishment Flock House, near the township of Bulls. This institution provided a group of boys who, in nearly all cases, came from rural areas.

This method of sampling, drawing subjects from the Forestry Service and Flock House, although not ideal, seemed the best compromise available.

Category (g) - Housewives and Unemployed:

It was hoped to locate the required 41 young housewives through the Plunket Society (New Zealand's maternal and child welfare programme) in areas such as the Porirua Basin near Wellington, where a large part of the residential population comprises young married couples. However, despite the fullest co-operation from the Plunket Society, this system was found to be largely unworkable in practice. The survey team spent three days with the equipment set up in three Plunket Rooms in likely areas and obtained only five subjects, the total number presenting at the rooms in the desired age bracket while the team was there. Category (g) unfortunately remained deficient in sample size at the completion of the field work.

The survey based on the sampling procedure described above was found to be time consuming but it did not set the survey team an impossible task. Table 2 shows the measure of success in achieving the sample goals (shown originally in Table 1) for each of the seven categories. Although the exact goals were not achieved, the sample sizes actually obtained under the somewhat difficult field conditions are considered to be sufficiently close to the theoretical ideals to allow the data produced in the survey to be extrapolated out to the 15 to 21 year old New Zealand population as a whole with confidence.

TABLE 1 : SAMPLE STRATA GOALS

The number of representatives required in each category to give a sample of 2000, divided between the categories in the ratios found in the total New Zealand population aged 15 to 21 years (based on the 1956 Census)

Category	Number of MALES required in the category	Number of FEMALES required in the category	Number of MALES PLUS FEMALES required in the category
(a) Private Employment	438	526	964
(b) Self Employment	37	7	44
(c) Government Departments and Local Authorities	33	50	83
(d) Armed Forces	21	3	24
(e) Educational	313	357	670
(f) Farming	158	16	174
(g) Housewives and Unemployed	.	41	41
TOTAL	1000	1000	2000

TABLE 2 : SAMPLE STRATIFICATION

The number of representatives in each category as calculated from census data for a total sample size of 2000, and the actual numbers obtained in the field survey

Category	MALES		FEMALES		MALES + FEMALES	
	Calculated Sample Size	Actual Sample Size	Calculated Sample Size	Actual Sample Size	Calculated Sample Size	Actual Sample Size
(a) + (b) Private Employment and Self Employment	475	532	533	585	1008	1117
(c) Government Departments and Local Authorities	33	56	50	74	83	130
(d) Armed Forces	21	20	3	3	24	23
(e) Educational	313	336	357	338	670	674
(f) Farming	158	196	16	.	174	196
(g) Housewives and Unemployed	.	.	41	5	41	5
TOTAL	1000	1140	1000	1005	2000	2145

2.2 Survey Design

2.2.1 General

The aims of this survey, outlined in section 1.2 of this report, demanded a rather comprehensive examination procedure. The general feeling at the time the survey was initiated was that gaining access to the subjects was going to be so difficult that the opportunity should be taken to collect just as much information as possible. On the other hand, as the success of the survey depended very largely on the goodwill of employers and educational authorities, it was decided that the duration of each examination and therefore the length of time the subject was away from his or her work should not exceed fifteen minutes. As the final survey design called for six radiographs per subject which took an average of two or three minutes to take, this left only twelve or thirteen minutes for the clinical examination. Once the examiner had committed the sequence of the examination to memory and became trained in it, and once the assistants were thoroughly familiar with the dictated codes and the examination form, it was possible to complete the clinical and radiographic examination within the time limit of fifteen minutes; employer co-operation with the survey team remained at a high level throughout the survey. No complaints about the length of time subjects were away from their work were received. The team was at all times conscious of the need to preserve good relations with the employers and educational authorities - a routine was quickly established and maintained throughout that ensured the subjects were not kept waiting and were in the dental chair for a minimum time.

2.2.2 Dental Caravan

Through the kind co-operation of Colonel J. Ferris Fuller and the Royal New Zealand Dental Corps, a dental caravan and truck together with the services of Sergeant Noel Trudgeon as driver and dental orderly were made available for the survey. For approximately the first half of the survey this caravan was used, being parked as close as possible to the working location of the subjects. An electric mains lead was run from the building to the caravan. The use of this caravan had several advantages, the main ones being that no call had to be made on the firm for working space for the survey team and it ensured a reasonably standardized examination environment which aided in the consistency of the examiner's diagnostic standards. The caravan, however, had disadvantages as well, and these finally led to the survey team abandoning the use of the caravan in the later phases of the survey. The major reasons for this change in procedure were: (a) the parking of the caravan often posed great problems, particularly with firms in the centre of the larger metropolitan areas. The Transport Department provided the survey team with very useful assistance in this, but many problems still remained. (b) the caravan could not be moved with any heavy equipment in it - all equipment including the x-ray machine had to be moved to and from the back of the truck at the start and finish of each examining session. Thus the inherent advantage of a dental caravan, having a mobile surgery ready to function as soon as the vehicle was parked, did not apply in this case. (c) the towing vehicles were found to be somewhat unreliable. (d) if the caravan was not parked on completely level ground the head of the x-ray machine had to be held by a lead-gauntleted hand during exposures. For all of these reasons the decision was reluctantly taken to abandon the use of the caravan. From that point on a station wagon or light van was used and the equipment set up in some convenient location within the place of business. This was often in a staff cafeteria or an unused office, but at times the team found itself in lavish board-rooms, in lubrication bays of garages, industrial

health nurses' surgeries, or surrounded by pianos or plumbers' supplies, or assailed by aromas of baking bread, brewing beer, cooking pickles, soap, chewing gum and fertilizer. On one occasion the front lawn was the only available site - fortunately on a sunny day. Depending upon the number of stairs to be climbed the team averaged about twenty minutes from the time of arriving at a business until all equipment was in, the x-ray machine assembled and it was ready to start examinations.

2.2.3 The Examination

All examinations were carried out by the same examiner (D.J.B.) Number 4 plane mouth mirrors and S.S. White "Tempryte" single ended sickle explorers were used. The explorers were sharpened according to the technique of Parfitt (5). Standardization of illumination was very difficult under the widely varying environments. An attempt at standardization was made by positioning in front of the patient a floor model "Angle-Poise" lamp with a bulb giving a colour temperature of approximately 5,500^oK (blue daylight). All examinations were made using a "double-check" technique - the information was recorded on the chart by an assistant at the time of the examination; simultaneously a tape recording was made of the examiner's dictation (a foot switch was used by the examiner to start the tape immediately before each statement and to stop it immediately after). The written record was later checked against the tape recording. On a very few occasions when an assistant was not available the examiner simply made a tape recording of his dictation and the written record was made from this later.

The original survey design called for a series of duplicate examinations to measure the extent of day-to-day variation in the examiner's diagnostic standards. For three reasons this was, unfortunately, not undertaken. Firstly, the survey relied very heavily on the co-operation of employers and educational authorities and the team felt strongly that, even with a single examination, they were making very considerable demands on their goodwill; to suggest that they should examine some subjects twice rather than once seemed to be asking too much. Secondly, the field work for the survey took 21 months to complete as it was; no time was available for duplicate examinations. Thirdly, as only one examiner was used throughout the survey, the problem of fluctuating diagnostic standards, although still present, was probably not present to such a marked degree as when several examiners are used. This deletion from the original survey design is a good example of the compromises that had to be made with the ideal in the interests of practicality.

The radiographic examination consisted of two posterior bite-wing films, two upper anterior periapical films and two lower anterior periapical films. All six exposures were made for each subject unless he or she was totally edentulous in any of these regions. The interpretation of radiographs was done in all cases by the author.

2.2.4 Recording and Scoring Procedures

All data were recorded on a xeroxed card (Figure 1).

2.2.4.1 Basic Data

For each subject the following information was obtained and recorded:

FIGURE 1

DEPARTMENT OF	HEALTH	-	DIVISION OF	DENTAL
Length of residence in district:	years.	Place of birth	Date of birth	Name
Occupation	Employer	Address	Examination at	No.
Location Code	Occupation Code	Code	Examined at	Age
X-RAY			19	Race
CLINICAL			19	Sex
Buccal Palatal Lingual Buccal	R 8		19	
CLINICAL			19	
X-RAY			19	
DENTAL CHART X-Rays Taken <input type="checkbox"/> X-Rays Read: I. Caries <input type="checkbox"/> 2. Periodontal Disease <input type="checkbox"/>				
RUSSELL PERIODONTAL SCORE				
DEBRIS - GREENE & VERNILLION - CALCIUS				
BODDECKER CARIES INDEX				
DENTAL SERVICES INDEX:				
TOOTHBRUSHING: Seldom <input type="checkbox"/> Daily <input type="checkbox"/> B.I.D. <input type="checkbox"/> T.I.D. <input type="checkbox"/>				
DMFT				
AFFECTED TOTAL CAVITIES INDEX				
OCCL				
PROX				
B-L				
OCCL				
PROX				
B-L				
TOTAL				
D FbulD				
M X				
F				
DMF				
Upper				
Ellis Class				
Treated				
Untreated				
Lower				
Total Teeth Score				
CALCULUS				
OPACITY				
HYPOPLASIA				

- (a) name
- (b) address
- (c) case number (an exclusive number - 1 to 2145 - assigned to each subject)
- (d) age
- (e) sex
- (f) length of residence in district in years
- (g) place of birth
- (h) date of birth
- (i) race
- (j) occupation
- (k) employer
- (l) place of examination (town, city, etc.)
- (m) date of examination

2.2.4.2. Dental Caries, Fillings and Extractions

(a) Point Prevalence Rates

To conform with the standardized method of reporting of dental disease laid down by WHO Expert Committee on Dental Health (6) the survey design called for the calculation of point prevalence ("the term recommended for use to describe the frequency of a disease or condition in existence at a particular point of time" (6).) A count was made of the numbers of persons with one or more cavities, with one or more teeth missing because of caries, with one or more teeth filled, and with one or more teeth DMF. These numbers were divided by the number of persons examined and multiplied by 100, to produce point prevalence rates of caries, of teeth missing due to caries, of filled teeth, and of DMF teeth.

(b) Bodecker Modified Dental Caries Index (7)

All caries data were originally dictated and recorded in this index, for it is the most detailed, and caries data recorded in this index may be transferred later into the other three indices. Briefly, using the Bodecker Modified Dental Caries Index, variable numbers of surfaces are available for caries attack on each tooth-type:

- (i) upper and lower incisors and canines -
 - 2 occlusal surfaces (incisal edge and palatal/lingual)
 - 2 proximal surfaces (mesial and distal)
 - 1 buccal-lingual surface (labial)
- (ii) upper premolars -
 - 1 occlusal surface
 - 2 proximal surfaces (mesial and distal)
 - 2 buccal-lingual surfaces (buccal and palatal)
- (iii) lower premolars -
 - 2 occlusal surfaces ("near occlusal" and "far occlusal")
 - 2 proximal surfaces (mesial and distal)
 - 2 buccal-lingual surfaces (buccal and lingual)

- (iv) upper first and second molars -
 - 3 occlusal surfaces ("near occlusal", "far occlusal" and palatal fissure)
 - 2 proximal surfaces (mesial and distal)
 - 2 buccal-lingual surfaces (buccal and palatal cervical)
- (v) upper third molars -
 - 2 occlusal surfaces ("near occlusal" and "far occlusal")
 - 2 proximal surfaces (mesial and distal)
 - 2 buccal-lingual surfaces (buccal and palatal)
- (vi) lower molars -
 - 2 occlusal surfaces (occlusal and buccal fissure)
 - 2 proximal surfaces (mesial and distal)
 - 2 buccal-lingual surfaces (buccal cervical and lingual)

The distribution of occlusal, proximal and buccal-lingual surfaces is shown diagrammatically for the entire dentition in Figure 2.

Using a chart of this type, the condition of each surface was recorded using the following code:

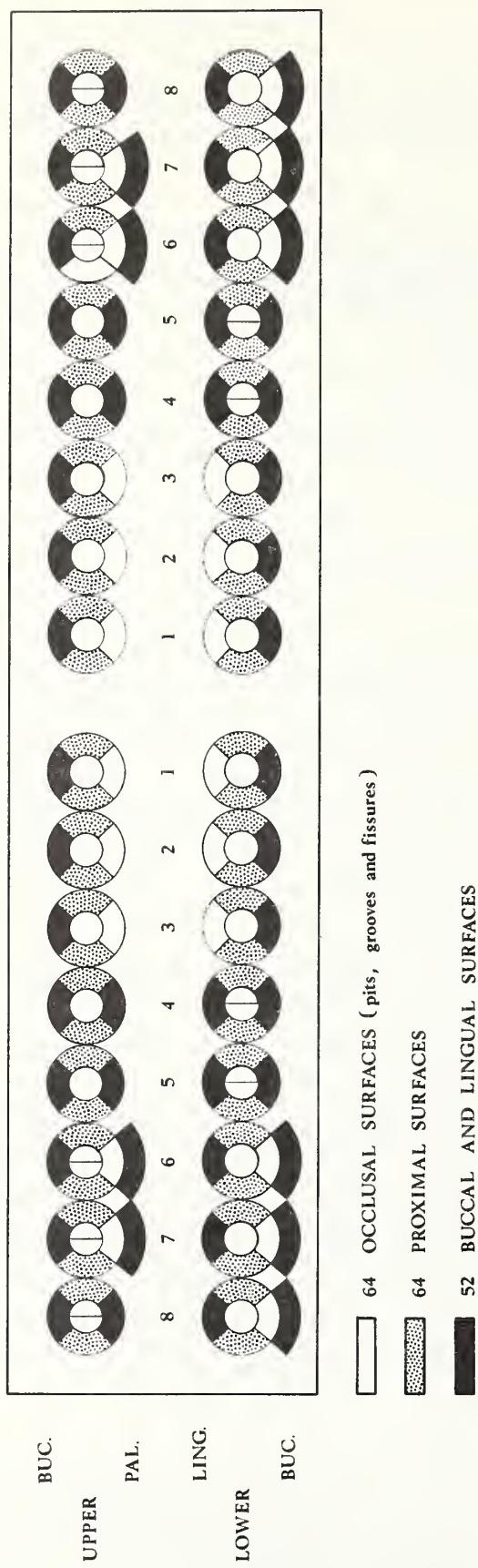
- (i) red - caries diagnosed clinically, including secondary caries on an already filled surface
- (ii) blue - filled, non-carious
- (iii) green - caries, diagnosed by radiograph, including secondary caries on an already filled surface
- (iv) "C" - crowned tooth
- (v) dot - tooth sound
- (vi) "X" - tooth extracted for caries
- (vii) "Xo" - tooth extracted for orthodontic reasons
- (viii) dash - tooth unerupted, congenitally absent or fractured.

In scoring the Bodecker Caries Index, teeth extracted because of caries were calculated as one affected occlusal surface, one affected proximal surface and one affected buccal-lingual surface. Teeth extracted for orthodontic reasons, unerupted teeth and fractured teeth were ignored. The number of affected surfaces in each of the three categories (occlusal, proximal, buccal-lingual) was calculated as a percentage of the number of surfaces normally present (i.e., surfaces on teeth actually present plus surfaces on teeth extracted because of dental caries). A percentage of surfaces affected was also calculated for the three categories of surfaces pooled together.

(c) DMF Teeth

Without a doubt, the most useful caries data to emerge from this survey are those presented in the DMFT index. The relative inferiority of caries data expressed by surface indices compared with teeth indices in epidemiological work of this kind is confirmed by the World Health Organization's Expert Committee on Dental Health (6).

FIGURE 2



On the basis of the surface information recorded on the Bodecker charts, teeth were classified into one of the following groups:

- (i) D - unfilled teeth that were carious; all teeth in this group were, from the clinical and radiographic evidence, savable.
- (ii) F but D - filled teeth that were secondarily carious; again, all teeth in this group were apparently savable.
- (iii) X - teeth, either filled or unfilled, which from clinical and/or radiographic evidence, were, in the examiner's opinion, unsavable and required extraction.
- (iv) M - teeth which were missing at the time of examination and which were judged to have been lost because of dental caries. In many cases an attempt to confirm this judgement was made by questioning the subject: "Can you remember whether you had this tooth removed because it was decayed or because there was not room for it?" A definite answer was obtained to this question in some but by no means all cases. With or without an answer, the clinical decision was still largely based on the examiner's judgement.
- (v) F - filled teeth which showed no sign, clinically or radiographically, of secondary caries.

(d) DMF Surfaces

In order to allow comparison with the published work of others, caries data were also calculated using Klein, Palmer and Knutson's (8) DMF Surfaces Index in which all teeth are assigned five surfaces. From the Bodecker record, using a working sheet, each tooth was scored for the number of decayed (D), filled (F), missing (M), and extraction indicated (X) surfaces. Those teeth with six or seven surfaces on the Bodecker diagram were condensed to a five surface diagram for scoring. Thus, two occlusal surfaces were counted as one surface, buccal fissure and buccal cervical were counted as one surface, and palatal fissure and palatal cervical were counted as one surface. If either or both Bodecker surfaces were affected, the one condensed surface was considered affected. If one of the surfaces to be condensed was filled and one carious, the condensed surface was considered carious. Teeth missing because of caries or requiring extraction were scored as five surfaces M or five surfaces X respectively. Unerupted teeth and teeth extracted for orthodontic reasons were not included.

2.2.4.3 The Dental Services Index

The Dental Services Index was developed for use in this study. Through its use it was hoped to fulfil the second aim of the survey: "The investigation of the amount of dental treatment this age group is currently receiving in New Zealand." It was also anticipated that the index would give some information called for under the third aim: "The investigation of the amount and nature of dental treatment

currently required by this age group." The index is a numerical value based on an arbitrary scale, applicable to individuals or population groups. The magnitude of the index is directly proportional to the amount of dental treatment required to make the individual or the population dentally fit. Thus, on an individual basis, it is directly related to the cost of dental services required to become dentally fit (assuming a standardized scale of fees). On a population basis, the index is directly related to the dental manpower, dental practice facilities, etc., required to make the population dentally fit. From the nature of the Dental Services Index the following relationships would apply: (a) the Dental Services Index will vary directly with the annual caries increment of age-specific populations; (b) the Dental Services Index will vary indirectly with the amount of dental treatment received before examination.

Thus the following three factors all interact: the Dental Services Index, the annual caries increment and the amount of previous dental treatment received. If any two of these factors are known it would be possible to judge the magnitude of the third. In the present survey the Dental Services Indices have been calculated and the annual caries increment (based on DMF teeth) is known. It is, therefore, possible to gain some estimate of the amount of dental treatment each age group has received prior to examination. (The Dental Services Index alone gives an indication of the amount of treatment required.) A comparison of these values for the subjects 16 years and over with those for 15 year olds who are receiving optimum treatment under the General Dental Benefits scheme indicates whether the older subjects are receiving less, about the same, or more dental treatment than the General Dental Benefits group, one of the primary aims of the survey.

The Dental Services Index is derived from a scale based on the scale of fees for General Dental Benefits treatment in force at the time the index was developed (1962). The index has been related to this scale of fees because it represents a convenient scale arrived at by negotiation, where the relative size of the fee for each type of treatment is directly related to the amount of time, effort, skill and materials required on the part of the dentist. The basic aim was not primarily to relate the treatment needs to actual cost but rather to produce an index where the value placed on each filling type was related to the time, effort, materials and skills required. This is an important distinction, fundamental to the concept of the Dental Services Index. Although the index is based on a scale of fees, the index is an arbitrary scale, the absolute value of which is of little significance. It is only the relative magnitude of the index in two individuals or two populations that is of interest. In this regard the index is comparable with other indices such as Russell's Periodontal Index. A PI of, say, 2.2 is somewhat meaningless in itself - it becomes far more meaningful when it is compared with the score of another individual or another population.

On the field record card (Figure 1) six boxes were provided for each tooth, adjacent to the Bodecker diagram, to record the treatment needs. Three of these boxes were to record a requirement of up to three fillings per tooth as deduced by clinical examination. The other three boxes were provided to allow modification of these filling requirements in the light of the radiographic examination. Each required filling was recorded by means of a code composed of one, two or three symbols. The three consist of the so-called major symbol, minor symbol and qualifying symbol. These are defined below:

(a) Major Symbol (Treatment required)

None	-	0
Class I	-	1
MO	-	2
DO	-	3
MOD	-	4
Class III	-	5
Class IV	-	6
Class V	-	7
Crown	-	8
Bridge	-	9
Extraction	-	10

(b) Minor Symbol

Buccal and/or lingual extension to Class I or II	-	A
Cusp restoration	-	B
Endodontia	-	C

(c) Qualifying Symbol

New filling (or crown, or bridge)	-	X
Replacement filling (or crown, or bridge)	-	Y
Extension to existing filling	-	Z

Thus for a tooth that was unfilled at the time of examination but required an MOD filling with a buccal extension, the treatment code would be:

4AX		
-----	--	--

Similarly, a tooth which did not have a DO filling at the time of examination, but required a DO filling with a cusp restoration and, in addition, had a buccal Class V filling which had recurrent caries around the margins and required replacement, would have treatment codes of:

3BX	7Y	
-----	----	--

If, on reading the radiograph, this tooth was found to have mesial caries as well and therefore required an MOD cusp restoration instead of a DO cusp restoration, its treatment codes became:

3BX	7Y	
4BX		

From the recorded treatment codes the dental services index for each filling was calculated using the conversion table (Table 3). The Dental Services Index for each subject was the sum of all the indices for each individual filling

(text continued on page 23)

TABLE 3 : CONVERSION TABLE, DENTAL SERVICES INDEX

The value of the dental services index for different treatment needs as recorded by treatment codes

TREATMENT CODE	DENTAL SERVICES for PREMOLAR	INDEX for MOLAR
1X	100	125
1Y	100	125
1Z	100	125
1AX	100	125
1AY	100	125
1AZ	100	125
1CX	505	525
1CY	505	525
2X	150	190
2Y	150	190
2Z	100	125
2AX	150	190
2AY	150	190
2AZ	100	125
2BX	275	345
2BY	275	345
2BZ	100	125
2CX	555	595
2CY	555	595
3X	150	190
3Y	150	190
3Z	100	125
3AX	150	190
3AY	150	190
3AZ	100	125
3BX	275	345
3BY	275	345
3BZ	100	125
3CX	555	595
3CY	555	595
4X	230	290
4Y	230	290
4Z	100	125
4AX	230	290
4AY	230	290
4AZ	100	125
4BX	275	345
4BY	275	345

TABLE 3 : CONVERSION TABLE. DENTAL SERVICES INDEX - continued

The value of the dental services index for different treatment needs as recorded by treatment codes

TREATMENT CODE	DENTAL SERVICES for PREMOLAR	INDEX for MOLAR
4BZ	100	125
4CX	635	695
4CY	635	695
		<u>for Anterior Teeth</u>
5X		175*
5Y		175
5CX		580
5CY		580
6X		630*
6Y		630
6CX		1035
6CY		1035
		<u>DENTAL SERVICES for PREMOLAR and ANTERIOR</u>
7X	100	125
7Y	100	125
7Z	100	125
7CX	505	525
7CY	505	525
		<u>for ANY Tooth</u>
8X	800	
8Y	800	
8CX	1205	
8CY	1205	
9X	1200*	
9Y	1200*	
9CX	1605*	
10	150	175
Examination, Prophylaxis and x-rays		210

- * Class III dental services indices have been based on silicate filling material; Class IV have been based on cast gold. During the examination, if there was any indication of possible weakening of the incisal edge during cavity preparation, the tooth was given a Class IV rather than a Class III treatment code. Some of these cases would doubtless end up as Class III cavities restored with cast gold and, due to their Class IV treatment code, a dental services index equivalent to cast gold would result.

- * Estimated - not on General Dental Benefits Fee Schedule.

required, plus 210, the Dental Services Index for examination, prophylaxis and bite-wing radiographs. (A Dental Services Index of 210 was therefore the lowest value in the scale, equivalent to a person who was found to be completely dentally fit). The conversion table (Table 3) is, as described above, based on a General Dental Benefits scale of fees with each fee converted into decimal currency (at the time the index was developed New Zealand was using a pounds, shillings and pence monetary system) and the decimal point moved two places to the right to make all indices integral numbers. For example, a General Dental Benefits fee of twelve shillings and sixpence would first be converted to decimal currency, giving NZ\$1.25; moving the decimal point two places to the right produces a Dental Services Index of 125.

Prosthetic needs were not included in the Dental Services Index as the need for prosthetic services and the adequacy of past prosthetic services were dealt with specifically in the survey (below).

2.2.4.4 Oral Hygiene Index

This survey was designed before Greene and Vermillion (9) had published their Simplified Oral Hygiene Index; the original, rather more detailed index of these workers (10) has been used. This index is composed of two separate parts, the oral debris index and the calculus index.

(a) Oral Debris Index

Two scores (one buccal and one lingual) were assigned to each of the six segments of the mouth (lower left, lower anterior, lower right, upper left, upper anterior, upper right). The scores for each segment were based on the buccal surface and the lingual surface which had the greatest surface area covered by debris. The amount of surface area covered was estimated by running the side of the sickle explorer along the surface, noting the occlusal or incisal extent of the debris. The following criteria were used in scoring:

- 0 - no debris or stain present
- 1 - soft debris covering not more than one third of the tooth surface, or the presence of extrinsic stains without other debris regardless of surface area covered
- 2 - soft debris covering more than one third, but not more than two thirds, of the exposed tooth surface
- 3 - soft debris covering more than two thirds of the exposed tooth surface.

The debris index for an individual subject was calculated to be the sum of the twelve scores, divided by six or by the number of segments scored if this were less than six.

(b) Calculus Index

As with the oral debris index so with the calculus index, two scores (buccal and lingual) were assigned to each of the six segments; the final index for each individual was the sum of these twelve scores, divided by six. The criteria for scoring calculus were as follows:

- 0 - no calculus present
- 1 - supragingival calculus covering not more than one third of the exposed tooth surface
- 2 - supragingival calculus covering more than one third but not more than two thirds of the exposed tooth surface or the presence of individual flecks of subgingival calculus around the cervical portion of the tooth or both
- 3 - supragingival calculus covering more than two thirds of the exposed tooth surface or a continuous heavy band of subgingival calculus around the cervical portion of the tooth or both.

(c) Oral Hygiene Index

This index was calculated as the sum of the debris index and the calculus index.

Information on frequency of toothbrushing was obtained by questioning each subject.

2.2.4.5 Russell Periodontal Index

The periodontal status of subjects taking part in the survey was assessed by the now well-established system of Russell (11). The clinical examination employed a plane mouth mirror, supplemented by periodontal probe, straight scaler and chip blower for demonstration of periodontal pockets.

Criteria for scoring, as defined by Russell (11) are shown below:

SCORE	CRITERIA AND SCORING FOR FIELD STUDIES	ADDITIONAL X-RAY CRITERIA
0	<u>Negative.</u> There is neither overt inflammation in the investing tissues nor loss of function due to destruction of supporting tissues.	Radiographic appearance is essentially normal
1	<u>Mild gingivitis.</u> There is an overt area of inflammation in the free gingivae, but this area does not circumscribe the tooth.	
2	<u>Gingivitis.</u> Inflammation completely circumscribes the tooth, but there is no apparent break in the epithelial attachment.	
4	(Not used in the field study)	There is early notch-like resorption of the alveolar crest.
6	<u>Gingivitis with pocket formation.</u> The epithelial attachment has been broken and there is a pocket (not merely a deepened gingival crevice due to swelling in the free gingivae). There is no interference with normal masticatory function, and the tooth is firm in its socket, and has not drifted.	There is horizontal bone loss involving the entire alveolar crest, up to half of the length of the tooth root (distance from apex to cementoenamel junction).
8	<u>Advanced Destruction with Loss of Masticatory Function.</u> The tooth may be loose; may have drifted; may sound dull on percussion with a metallic instrument; may be depressible in its socket.	There is advanced bone loss, involving more than one-half of the length of the tooth root; or a definite intrabony pocket with definite widening of the periodontal membrane. There may be root resorption, or rarefaction at the apex.

RULE: When in doubt, assign the lesser score

The score for each subject is the arithmetic average of the scores for the teeth in the mouth.

2.2.4.6 Prosthetics

The presence of, or the need for prosthetic appliances was noted during examination and recorded by the following two-symbol code (the first symbol applies to the upper jaw, the second symbol to the lower).

UPPER JAW	LOWER JAW	
0	0	Edentulous - new full denture required
1	1	Full clearance required - new full denture required
2	2	Wearing full denture - satisfactory
3	3	Wearing full denture - replacement required
4	4	Wearing full denture - repair or remake required
5	5	Partially edentulous - new partial denture required
6	6	Extractions required - new partial denture required
7	7	Wearing partial denture - satisfactory
8	8	Wearing partial denture - replacement required
9	9	Wearing partial denture - repair or remake required

2.2.4.7 Fractured Anterior Teeth

The presence of fractured anterior teeth was recorded, using the classification of Ellis (12) :

- Class 1 - Simple fracture of the crown - involving little or no dentine
- Class 2 - Extensive fracture of the crown - involving considerable dentine, but not the dental pulp
- Class 3 - Extensive fracture of the crown - involving considerable dentine and exposing the dental pulp.
- Class 4 - The traumatized tooth which becomes nonvital - with or without loss of crown structure
- Class 5 - Teeth lost as a result of trauma
- Class 6 - Fracture of the root - with or without loss of crown structure
- Class 7 - Displacement of a tooth - without fracture of crown or root
- Class 8 - Fracture of the crown en masse and its replacement
- Class 9 - Traumatic injuries to deciduous teeth

A record was also made of whether or not the fractured tooth had been treated.

2.2.4.8 Descriptive Calculus Code

This code, developed for the pilot study of the survey was superseded in the main survey by Greene and Vermillion's Calculus Index (section 2.2.4.4 above). However, the descriptive code was in fact recorded throughout the survey. Processing of the data collected by Greene and Vermillion's Calculus Index and our own Descriptive Calculus Code demonstrated that the latter gave no extra or more useful information than that provided by Greene and Vermillion's index. Reporting of the results of the Descriptive Calculus Code is therefore not warranted. For the sake of completeness, details of the Descriptive Calculus Code are given in brief. A code, intended to produce information on the prevalence of the various clinical types of calculus deposition, was assigned to each subject. Each code consisted of one figure and one or more letters, according to the following criteria:

1 - light deposits)	(A - lower anteriors
2 - medium deposits)	on (B - upper molars
3 - heavy deposits)	(C - other teeth

The terms "light", "medium" and "heavy" were explicitly defined.

2.2.4.9 Enamel Opacities

Where enamel opacities were noted the degree to which the dentition was affected was recorded on a 1 to 6 scale. The term opacity was taken to include abnormalities in translucency and intrinsic pigmentation, but in all cases the enamel was hard and smooth. The six degrees of opacity were:

- 1 - White opaque flecks, spots or patches involving less than 25 per cent of the surface area, and involving six teeth or less.
- 2 - Same as 1, but involving more than six teeth.
- 3 - White opaque flecks, spots or patches involving 25 to 50 per cent of the surface area, and involving six teeth or less.
- 4 - Same as 3, but involving more than six teeth.
- 5 - White opaque flecks, spots or patches involving more than 50 per cent of the surface area, and involving six teeth or less.
- 6 - Same as 5, but involving more than six teeth.

This scoring system was a modification of that described by Davies, Losee, Cadell, Kean and Ludwig (13).

2.2.4.10 Enamel Hypoplasia

The scoring system used for enamel hypoplasia was also a modification of that described by Davies, Losee, Cadell, Kean and Ludwig (13) :

- 1 - Part or whole of the enamel surface is rough but there is no evidence of pitting, and six teeth or less are involved.
- 2 - Same as 1, but with more than six teeth involved.

- 3 - The enamel surface is rough and there is pitting which involves less than 50 per cent of the surface area, and six teeth or less are involved.
- 4 - Same as 3, but with more than six teeth involved.
- 5 - The enamel surface is rough and there is pitting which involves more than 50 per cent of the surface area, and six teeth or less are involved.
- 6 - Same as 5, but with more than six teeth involved.

2.2.4.11 Oral Surgery Treatment Requirements

The presence of impacted third molar teeth was recorded. The number of such teeth found on clinical examination and the additional number, if any, found on radiographic examination were noted. Any other conditions requiring oral surgery were also noted, the condition being specified. The examiner made a clinical decision as to whether or not treatment was actually necessary.

2.2.4.12 Handicapping Dento-facial Anomalies

The handicapping dento-facial anomalies defined by the World Health Organization's Expert Committee on Dental Health (6) formed a part of the examination procedure. The examiner's decision as to whether or not treatment was required was recorded. The anomaly was regarded as requiring treatment if it was, or likely to be, an obstacle to the patient's physical or emotional well-being.

If treatment was regarded as being necessary, the nature of the anomaly was indicated in the following check-list:

Cleft lip	Cleft palate
Prognathism	Retrognathism
Crowding	Spacing
Deep overbite	Open bite
Other - specify	

2.2.4.13 Other Conditions and Comments

Allowance was made on the field survey form for recording other conditions and comments not specifically covered elsewhere on the form. Entries were made in this section either at the time of the clinical examination or when reading the radiographs.

2.2.4.14 Dental Treatment History

In order to collect information on the dental treatment history of the subjects, they were given the following questionnaire, based on that described by Davies (14) :

1. How many months is it since you last went to the dentist?
2. Did you attend a school dental nurse regularly as a child? (yes or no)

If the answer to question 2 is yes, complete this block:

3. Did you attend a dentist regularly after leaving the school dental nurse? (yes or no)
4. Did you continue to attend the dentist regularly after the age of 15? (yes or no)

If the answer to question 2 is no, complete this block:

5. Have you attended a dentist regularly throughout childhood and up to the present time? (yes or no)

To improve accuracy and speed, this questionnaire was put to the subjects verbally rather than letting them read the questionnaire and record their own answers. The term "regular dental care" was defined by the survey team to each subject as treatment in which the longest interval between successive dental appointments had been twelve to eighteen months.

2.3 Pilot Study

In order to establish the feasibility of the sampling procedures and survey methods described above, a pilot study was conducted in the Wellington-Palmerston North area between 28 August 1962 and 31 October 1962. The firms and organizations included in the pilot study are listed in Appendix One. The pilot study also provided the preliminary estimates required to calculate the sample sizes required in the main survey.

It was decided that the pilot study would either be an entirely separate study or it could form a part of the main survey. This decision was to be made in the light of the number and significance of changes in sampling and/or survey design which were required following the experience gained in the pilot study. In fact, at the completion of the pilot study only four changes were made in the survey design (none of which was very significant) and no changes in the sampling method. It was therefore possible to include the 213 subjects examined in the pilot study as a part of the sample for the main study. The modifications in study design introduced at the end of the pilot study were as follows:

- (a) Oral Hygiene Index. In the pilot study oral debris was scored by a system which differed somewhat from that described by Greene and Vermillion (10) and calculus was recorded by the Descriptive Calculus Code (section 2.2.4.8 above). For the main study the Oral Hygiene Index of Greene and Vermillion (10) was introduced, the pilot study oral debris scoring system was deleted, but the Descriptive Calculus Code was retained. The results of the Greene and Vermillion Oral Hygiene Index necessarily exclude data for the 213 pilot study subjects.
- (b) Extrinsic Stains. Allowance was made in the pilot study for recording extrinsic stains on the teeth. In the age group with which this survey was concerned, it was found that this classification of subjects simply divided them, roughly, into smokers and non-smokers. In view of this very limited usefulness of recording extrinsic stains this aspect of the survey design was deleted from the main survey.
- (c) Fractured Anterior Teeth. There was no specific provision in the pilot study for recording the presence of fractured anterior teeth. They were simply noted in the "Other Conditions and Comments" section of the field survey form. To simplify the recording procedure the system described in section 2.2.4.7 above was introduced into the main survey.
- (d) Dental Treatment History. The questionnaire used to obtain information on the subjects' dental history was rather more detailed in the pilot study than in the main survey. Questions such as "for how many years did you attend a school dental nurse?" and "at what age did you stop being treated by a school dental nurse?" were included. It was found that in many cases it was impossible to obtain accurate replies to these questions, and, in addition, they resulted in serious waste of time while the subject tried to remember the answers. For these reasons the questionnaire for the main survey was simplified to that shown in section 2.2.4.14 above.

2.4 Sample Size

The calculation of the sample size required in each age-sex group was based on the DMF teeth data of the pilot study. The mean number of DMF teeth per person and the standard deviation among the 213 subjects, age-sex pooled, of the pilot study were taken as working estimates for each age-sex specific group of the main survey. The values obtained from the pilot study and used in the calculation of sample size were as follows:

Mean DMF teeth per subject	=	19.86
Standard deviation	=	5.37

The accuracy aimed at for the main survey was a sampling error of not more than 5 per cent (at the 95 confidence level) in the mean DMF figures for each age-sex specific group. The sample size to produce this level of accuracy was calculated as follows:

$$n = \frac{4(SD)^2}{(M_{DMF})^2 (\frac{x}{100})^2}$$

where, n = sample size
 SD = standard deviation (estimate from the pilot study)
 M_{DMF} = mean DMF teeth per subject (estimate from the pilot study)
 X = percentage sampling error

$$n = \frac{4 (5.37)^2}{(19.86)^2 (\frac{5}{100})^2}$$

$$= 117$$

This therefore was the required sample size for each of the fourteen age-sex groups, giving a total required sample of $(117 \times 14) = 1638$. Bringing this to a round figure and, at the same time, allowing for error and variability, a total sample of 2000 (1000 males and 1000 females) was arrived at.

As shown in Table 2 earlier, the actual sample obtained in the field numbered 2145.

2.5 Data Processing

Virtually all of the information collected for this survey was transferred on to 80-column punch cards for processing, using one card per subject. The card is shown in Figure 3. The 76 columns of the card that were used were punched as follows:

- (a) Case Number (columns 1-4) An assigned number ranging from 1 to 2145
- (b) Age (columns 5-6) A range of 15 to 21
- (c) Sex (column 7) This column was punched as follows:
Male = 1
Female = 2
- (d) Race (column 8) The following code was used:
European = 1
Maori = 2
Asian = 3

A subject was counted as being of Maori or Asian extraction if he showed any trace of Maori or Asian blood.

- (e) Location (columns 9-12) Column 9 was used to distinguish between life-long residents of a district and those who were not life-long residents
life-long resident = 1
non life-long resident = 2

FIGURE 3

Columns 10-12 were punched with a three-digit code based on territorial local authorities (counties, boroughs and town districts). This code is shown in Appendix Two.

(f) Occupation (columns 13-14) A two-digit code was used to record the subjects' occupations. This code, shown in Appendix Three, was based on that of the Department of Statistics.

(g) Modified Bodecker Dental Caries Index (columns 15-22) The four components of the Bodecker Index were assigned to the following columns on the punch card:

occlusal caries index	- columns 15-16
proximal caries index	- columns 17-18
buccal-lingual caries index	- columns 19-20
general caries index	- columns 21-22

These were used for punching the percentage of each surface-type affected by caries in the mouth. The general caries index represents the percentage of all tooth surfaces affected.

(h) DMF Teeth (columns 23-36) These fourteen columns were used as follows:

- (i) Total teeth, i.e., the number of teeth actually present in the mouth, plus the number of teeth that had been extracted because of dental caries - columns 23-24.
- (ii) D teeth, i.e., the number of unfilled teeth that were carious, but savable - columns 25-26.
- (iii) F but D teeth, i.e., the number of filled teeth that were secondarily carious, but savable - columns 27-28.
- (iv) M teeth, i.e., the number of teeth which had been extracted because of dental caries - columns 29-30.
- (v) X teeth, i.e., the number of teeth, either filled or unfilled, which were unsavable and required extraction - columns 31-32.
- (vi) F teeth, i.e., the number of filled teeth with no sign of secondary caries - columns 33-34.
- (vii) DMF teeth, i.e., the number of teeth that had at some time in the subject's life been affected by dental caries. This category was the sum of the numbers of D teeth, F but D teeth, M teeth, X teeth, and F teeth - columns 35-36.

(i) Dental Services Index (columns 37-41). These five columns allowed the recording of the dental services index. The highest value for this index actually recorded in the survey was 8440.

(j) Greene and Vermillion Oral Hygiene Index (columns 42-48). These seven columns were assigned as follows:

- (i) Oral Debris Index, ranging from 0.0 to 6.0 - columns 42-43
- (ii) Calculus Index, ranging from 0.0 to 6.0 - columns 44-45
- (iii) Oral Hygiene Index, the sum of the debris index and the calculus index, ranging from 0.0 to 12.0 - columns 46-48

The entire Greene and Vermillion section (columns 42-48) was not applicable in totally edentulous subjects, and was punched X X X X X X X. In case numbers 1 to 213 inclusive, the subjects in the pilot study where the Greene and Vermillion index was not used, columns 42-48 were punched Y Y Y Y Y Y Y.

- (k) Frequency of Toothbrushing (column 49). The following code was used to record the frequency of toothbrushing:

never	=	0
seldom	=	1
daily	=	2
twice daily	=	3
three times daily	=	4
not applicable (edentulous)	=	X
not applicable (pilot study)	=	Y

- (l) Russell Periodontal Index (columns 50-51). This index ranged from 0.0 to 3.0. For the totally edentulous subject where the index was not applicable, columns 50 and 51 were punched X X.
- (m) Prosthetics (columns 52-53). The recording code described in section 2.2.4.6 above, for the presence of, or need for, prosthetic appliances was also used as the punching code. Column 52 applied to the upper jaw and column 53 to the lower jaw. In most subjects this section was not applicable and was punched X X.
- (n) Descriptive Calculus Code (columns 54-55). The recording code was described in section 2.2.4.8 above. The two-digit punching code corresponding to these recording codes was as follows:

Recording Code	Punching Code
1A	11
1B	12
1C	13
1AB	14
1AC	15
1BC	16
1ABC	17
2A	21
2B	22
2C	23
2AB	24
2AC	25
2BC	26
2ABC	27
3A	31
3B	32
3C	33
3AB	34
3AC	35
3BC	36
3ABC	37
Not applicable (no calculus)	00

- (o) Enamel Opacity (column 56). The recording code (1 to 6) described in section 2.2.4.9 above, was punched directly into column 56. In the absence of enamel opacity this column was punched 0.
- (p) Enamel Hypoplasia (column 57). The same code was used for punching as that used at the time of examination. When not applicable column 57 was punched 0.
- (q) Last Appointment (columns 58-60). These columns were used to record the number of months since the subject last visited a dentist, ranging from 000 upward. To indicate a subject who had never been to a dentist at any time these columns were punched X X X.
- (r) Dental Treatment History (column 61). Subjects were categorised into ten treatment history groups according to age and to the replies to the questionnaire described in section 2.2.4.14 above. It was necessary to distinguish between 15 year old subjects and 16 to 21 year old subjects as the former were still eligible for dental care under General Dental Benefits; one question in the questionnaire was not applicable for this age group. Column 61 was punched 0 to 9 according to the following schedule:

Age of subject	Code	Regular treatment by school nurse	Regular treatment by dentist under General Dental Benefits	Regular treatment by dentist after General Dental Benefits	Regular treatment by dentist throughout life
16 - 21 years	0	Yes	Yes	Yes	-
	1	Yes	Yes	No	-
	2	Yes	No	No	-
	3	Yes	No	Yes	-
	4	No	-	-	Yes
	5	No	-	-	No
15 years	6	Yes	Yes	N.A.	-
	7	Yes	No	N.A.	-
	8	No	-	N.A.	Yes
	9	No	-	N.A.	No

(s) DMF Surfaces (columns 62-76). These columns were divided among the components of the DMF Surface Index as follows:

- (i) D surfaces, i.e., the number of decayed tooth surfaces in the mouth - columns 62-64.
- (ii) F surfaces, i.e., the number of filled tooth surfaces - columns 65-67.
- (iii) M surfaces, i.e., the number of surfaces represented on those teeth that had been extracted because of dental caries (5 surfaces per tooth) - columns 68-70.
- (iv) X surfaces, i.e., the number of surfaces on those teeth that were beyond conservative treatment and required extraction (5 surfaces per tooth) - columns 71-73.
- (v) DMXF surfaces, i.e., the total number of surfaces in the mouth that at some time had been attacked by dental caries. This number was the sum of the number of D surfaces, M surfaces, X surfaces and F surfaces - columns 74-76.

To facilitate the punching of cards all data were first transferred from each field dental survey card (Figure 1) to a punching schedule shown in Figure 4.

FIGURE 4

- 1- 4 Case Number
- 5- 6 Age
- 7 Sex
- 8 Race
- 9-12 Location
- 13-14 Occupation
- 15-16 Occ. Caries Index
- 17-18 Prox. Caries Index
- 19-20 B.-L. Caries Index
- 21-22 Gen. Caries Index
- 23-24 Total Teeth
- 25-26 D Teeth
- 27-28 F but D Teeth
- 29-30 M Teeth
- 31-32 X Teeth
- 33-34 F Teeth
- 35-36 DMF Teeth
- 37-41 Services Index
- 42-43 G. and V. - Debris
- 44-45 G. and V. - Calculus
- 46-48 G. and V. - O.H.
- 49 Brushing
- 50-51 Russell Perio.
- 52-53 Prosthetic
- 54-55 Calculus
- 56 Opacity
- 57 Hypoplasia
- 58-60 Last Appt.
- 61 Treatment History
- 62-64 D Surfaces
- 65-67 F Surfaces
- 68-70 M Surfaces
- 71-73 X Surfaces
- 74-76 DMXF Surfaces

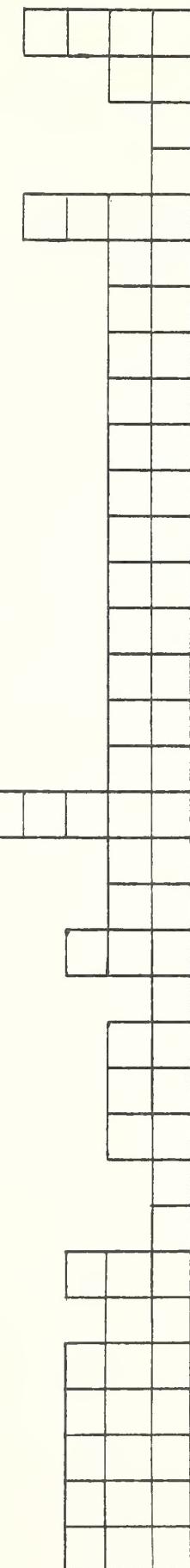


Figure 4 - Punching Schedule. Data were transferred from the field survey form to the punching schedule to facilitate punching.

Using an I.B.M. Model 421 Tabulator, the data on the punch cards were summarised, print-out being in the form of age-sex specific frequency distributions.

The following sections of the survey which did not lend themselves to processing by punch card were processed manually:

- (a) Fractured anterior teeth
- (b) Oral surgery treatment requirements
- (c) Handicapping dento-facial anomalies
- (d) Other conditions and comments

SECTION 3 : RESULTS

3.1 Age-Sex Distribution

A total of 2145 subjects were examined in this study. The age-sex distribution is shown in Table 4.

3.2 Racial Distribution

Table 5 shows the racial distribution of the subjects.

3.3 Accuracy of Field Records

The use of a tape recorder during the examinations permitted a check to be made on the accuracy of the field records; the written record was double-checked later against the tape recording of the examiner's dictation. For a randomly selected series of 250 subjects (case numbers 1120 to 1370 inclusive) a record was kept of the number of errors detected by this means. The total number of errors was 50. Thirty-six of these were in the recording of the dental caries data; usually a single surface recorded as carious instead of filled, or vice versa; four errors were found in the recording of the treatment services indices; there were six errors in the Russell Periodontal Index and four errors in the Greene and Vermillion Oral Hygiene Index.

3.4 Dental Caries, Fillings and Extractions

(a) Point Prevalence Rates

Table 6 presents the findings of this survey as regards caries prevalence, expressed by point prevalence rates (the frequency of dental caries in existence at a particular point in time). The total number of subjects and the percentage of subjects with one or more decayed teeth requiring dental attention (D teeth), with one or more teeth missing because of dental caries (M teeth), with one or more teeth filled (F teeth) and with one or more teeth showing evidence of having been attacked by dental caries at some time during the subject's life (DMF teeth) are shown. At all age groups and in both sexes approximately 90 per cent of the subjects had one or more decayed teeth awaiting attention. There seemed to be no great change in this rate with age. The rate for subjects with one or more missing teeth, however, showed a rise with increasing age in both sexes, and a tendency for the rates to be somewhat higher in the male than in the female. A very high prevalence of subjects with one or more filled teeth and one or more DMF teeth was found in all age groups and both sexes.

(b) Modified Bodecker Dental Caries Index

Despite the somewhat limited usefulness of surface indices as a measure of caries prevalence in epidemiological work, the results are reported for caries prevalence expressed by the Modified Bodecker Dental Caries Index (Table 7). This has been done to give an indication of the relative susceptibility of the three surface types (occlusal, proximal and buccal-lingual). The proximal surfaces are shown to have the highest susceptibility, the occlusal surfaces second highest and the gingival surface the lowest susceptibility. The findings for occlusal surfaces are affected by the fact that this surface type includes the incisal edges of incisor teeth and the cusps of canine teeth which are of very low susceptibility, as well as the occlusal, buccal and palatal fissures of posterior teeth which have a high susceptibility.

TABLE 4 : AGE-SEX DISTRIBUTION

The number of subjects included in the survey
Age and sex specific and pooled

MALE		FEMALE		MALE AND FEMALE	
Age in years	Number of subjects	Age in years	Number of subjects	Age in years	Number of subjects
15	158	15	135	15	293
16	233	16	199	16	432
17	207	17	239	17	446
18	231	18	166	18	397
19	148	19	140	19	288
20	124	20	99	20	223
21	39	21	27	21	66
15-21	1140	15-21	1005	15-21	2145

TABLE 5 : RACIAL DISTRIBUTION

The number of subjects in each of three racial groups
Age pooled and sex specific and pooled

Number of Subjects				
SEX	EUROPEAN	MAORI	ASIAN	TOTAL
MALE	1067	71	2	1140
FEMALE	944	54	7	1005
MALE AND FEMALE	2011	125	9	2145

TABLE 6 : POINT PREVALENCE RATES

The total number, and the percentage, of subjects with one or more cavities (D teeth), one or more teeth missing because of caries (M teeth), one or more teeth filled (F teeth), and one or more teeth showing evidence of having been attacked by caries at sometime during the subject's life (DMF teeth). Data presented age specific, and sex specific and pooled.

Sex	Age in years	Number of subjects	Subjects with one or decayed		Subjects with one or missing		Subjects with one or filled teeth		Subjects with one or more DMF teeth	
			Total	Per cent	Total	Per cent	Total	Per cent	Total	Per cent
MALE	15	158	143	93.7	18	11.4	154	97.5	156	98.7
	16	233	217	93.1	50	21.5	224	96.1	232	99.6
	17	207	198	95.7	51	24.6	195	94.2	206	99.5
	18	231	219	94.8	68	29.4	216	93.5	231	100.0
	19	148	139	93.9	56	37.8	136	91.9	148	100.0
	20	124	119	95.9	58	46.8	119	95.9	124	100.0
	21	39	36	92.3	21	53.8	36	92.3	38	97.4
FEMALE	15	135	128	94.8	10	7.4	133	98.5	135	100.0
	16	199	187	93.9	43	21.6	193	96.9	199	100.0
	17	239	225	94.1	70	29.3	230	96.2	238	99.6
	18	166	146	87.9	56	33.7	160	96.4	165	99.4
	19	140	125	89.3	59	42.1	133	95.0	138	98.6
	20	99	88	88.9	38	38.4	92	92.9	95	95.9
	21	27	23	85.2	12	44.4	27	100.0	27	100.0
MALE AND FEMALE	15	293	276	94.2	28	9.6	287	97.9	291	99.3
	16	432	404	93.5	93	21.5	417	96.5	431	99.8
	17	446	423	94.8	121	27.1	425	95.3	444	99.6
	18	397	365	91.9	124	31.2	376	94.7	396	99.7
	19	288	264	91.7	115	39.9	269	93.4	286	99.3
	20	223	207	92.8	96	43.0	211	94.6	219	98.2
	21	66	59	89.4	33	50.0	63	95.5	65	98.5

TABLE 7 : MODIFIED BODECKER DENTAL CARIOS INDEX

Caries prevalence among the New Zealand population aged 15 to 21 years, age specific, sex specific and pooled, expressed as the percentage of occlusal surfaces, the percentage of proximal surfaces, the percentage of buccal lingual surfaces, and the percentage of all surfaces affected by dental caries.

Sex	Age in years	Number of subjects	Percentage of occlusal surfaces affected by dental caries	Percentage of proximal surfaces affected by dental caries	Percentage of buccal-lingual surfaces affected by dental caries	Percentage of all surfaces affected by dental caries
MALE	15	158	33.9	38.3	8.4	28.3
	16	233	36.6	42.7	8.9	30.9
	17	207	36.6	43.8	9.7	31.5
	18	231	38.9	44.9	11.3	33.2
	19	148	38.1	45.2	10.6	32.7
	20	124	39.8	45.3	13.2	34.3
	21	39	39.9	40.9	14.2	32.6
FEMALE	15	135	39.5	45.2	9.9	33.4
	16	199	37.4	43.5	8.5	31.4
	17	239	39.1	45.2	10.3	33.2
	18	166	38.7	44.9	11.1	33.2
	19	140	38.9	43.9	10.9	32.9
	20	99	39.2	45.1	12.3	33.7
	21	27	43.4	51.8	14.3	37.9
MALE AND FEMALE	15	293	36.5	41.5	9.1	30.6
	16	432	36.9	43.1	8.8	31.2
	17	446	37.9	44.6	10.0	32.4
	18	397	38.8	44.9	11.2	33.2
	19	288	38.5	44.6	10.8	32.8
FEMALE	20	223	39.5	45.2	12.8	34.1
	21	66	41.4	45.4	14.2	34.8

It can also be seen by an examination of Table 7 that the intensity of yearly attack, which has resulted in the high indices by age 15 years is reducing by ages 15 to 21. The male is still showing a quite high annual attack rate in the years 15 to 16, 16 to 17 and 17 to 18 (caries indices: 28.3, 30.9, 31.5, 33.2) but in subsequent years there is very little change in indices, indicating a low attack rate. In females the caries indices have virtually reached a plateau by age 15, with the exception of age 21 (caries index: 37.9) where the sudden apparent increase in caries could well be an artefact due to the small sample ($n = 27$).

The most significant increases in caries indices with age appear to be in the buccal-lingual surfaces; this is probably due to the fact that nearly all susceptible occlusal and proximal surfaces are already involved in dental caries by age 15, whereas the attack on the gingival surfaces continues, at least until age 21.

Despite serious doubts during the stage of survey planning about the necessity or even desirability of including Bodecker's Caries Index, the results shown in Table 7 and described above are of interest; they provide a small but nevertheless useful addition to the knowledge acquired through the DMF Teeth Index (section 3.4 (c), below) and also allow interesting comparisons with the published work of others, particularly the work of Hewat and Eastcott (15).

(c) DMF Teeth

The results for dental caries prevalence expressed by the most useful of the four caries indices, the DMF Teeth Index, are given in Table 8. As described earlier, this index has been modified for this survey by the subdivision of decayed (D) teeth into unfilled teeth that were carious but savable (D), filled teeth that were secondarily carious but savable (F but D) and decayed teeth that required extraction (X). In addition to these three categories of decayed teeth, the numbers of teeth in each of the other two conventional categories of the DMFT index, missing (because of dental caries) teeth (M), and filled (F) teeth are presented. The summation of all five categories, the DMFT, is also shown in Table 8. The total numbers of teeth normally present (i.e. the actual numbers of teeth present plus the numbers of teeth extracted because of dental caries) are presented to allow the calculation of the DMF teeth per 100 teeth index. The data of Table 8 are summarized in Figure 5.

Sex differences are apparent in the dental caries data. The annual increment in caries in the male (as indicated by the upper line of the graphs of Figure 5) was found to be rather high in this age whereas in the female the high annual incidence during childhood (which resulted in a mean of about eighteen teeth involved by age fifteen) had to a certain extent abated during late adolescence, as indicated by the relatively flat form of the graph (Figure 5) in this area. The apparent increase in DMF at age 21 in the female may have been an artefact resulting from the smaller sample size in this group.

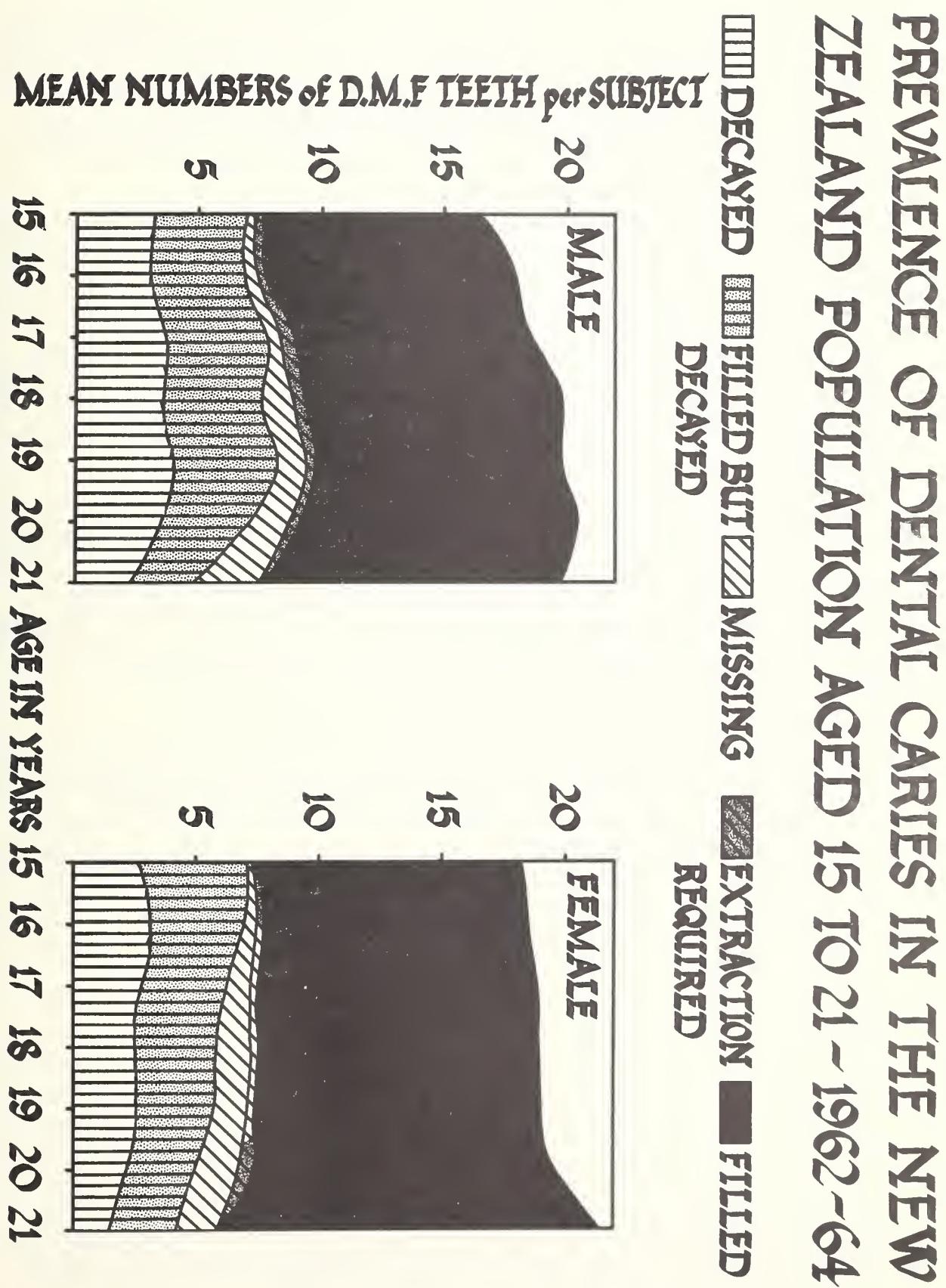
In the male, dental fitness tended somewhat to deteriorate from the high level of childhood during these later years, as indicated by the mild increase in the numbers of decayed teeth up to the age of 19. This same tendency was suggested by the continuing increase in the numbers of missing teeth; however, this latter index was found to be affected by quite small numbers of edentulous subjects (i.e., 32 missing teeth) - with such a

TABLE 8 : DMF TEETH INDEX

Dental caries prevalence among the New Zealand population aged 15 to 21, age specific, and sex specific and pooled, expressed by the DMFT Index (modified): the numbers of teeth decayed (savable), filled but decayed (savable), requiring extraction, extracted because of dental caries, filled, and the summation of each of these categories, the DMFT Data presented both for the total numbers of teeth in the group, and the mean per subject.

Sex	Age in years	Number of subjects	Teeth normally present		Decayed teeth, savable D		Filled but decayed teeth savable F but D		Decayed teeth requiring extraction X		Decayed teeth extracted because of dental caries M		Filled teeth F		Decayed, missing & filled teeth DMFT	
			Total	Mean	Total	Mean	Total	Mean	Total	Mean	Total	Mean	Total	Mean	Total	Mean
MALE	15	158	4355	27.56	522	3.30	574	3.63	13	0.08	56	0.35	1451	9.18	2616	16.56
	16	233	6476	27.79	693	2.97	892	3.83	41	0.18	106	0.46	2444	10.49	4176	17.92
	17	207	5858	28.29	771	3.73	841	4.06	106	0.51	102	0.49	2028	9.79	3848	18.59
	18	231	6626	28.68	814	3.52	898	3.89	106	0.46	316	1.37	2433	10.53	4567	19.77
	19	148	4305	29.09	589	3.98	642	4.34	28	0.19	165	1.12	1490	10.07	2914	19.69
	20	124	3669	29.59	425	3.43	447	3.61	49	0.39	197	1.59	1410	11.37	2528	20.39
	21	39	1175	30.13	84	2.15	100	2.56	0	0.00	109	2.79	479	12.28	772	19.79
FEMALE	15	135	3662	27.13	360	2.67	597	4.42	1	0.01	19	0.14	1467	10.87	2444	18.10
	16	199	5516	27.72	621	3.12	728	3.66	10	0.05	113	0.57	2187	10.99	3659	18.39
	17	239	6711	28.08	655	2.74	827	3.46	8	0.03	230	0.96	2791	11.68	4511	18.87
	18	166	4715	28.40	405	2.44	540	3.25	25	0.15	247	1.49	1907	11.49	3124	18.82
	19	140	4017	28.69	347	2.48	433	3.09	9	0.06	184	1.31	1668	11.91	2641	18.86
	20	99	2885	29.14	203	2.05	262	2.65	57	0.58	139	1.40	1256	12.69	1917	19.36
	21	27	781	28.93	36	1.33	75	2.78	0	0.00	40	1.48	423	15.67	574	21.26
MALE AND FEMALE	15	293	8017	27.36	882	3.01	1171	3.99	14	0.05	75	0.26	2918	9.96	5060	17.27
	16	432	11992	27.76	1314	3.04	1620	3.75	51	0.12	219	0.51	4631	10.72	7835	18.14
	17	446	12569	28.18	1426	3.19	1668	3.74	114	0.26	332	0.74	4819	10.80	8359	18.74
	18	397	11341	28.57	1219	3.07	1438	3.62	131	0.33	563	1.42	4340	10.93	7691	19.37
	19	288	8322	28.89	936	3.25	1075	3.73	37	0.13	349	1.21	3158	10.97	5555	19.29
	20	223	6554	29.39	628	2.82	709	3.18	106	0.48	336	1.51	2666	11.96	4445	19.93
	21	66	1956	29.64	120	1.82	175	2.65	0	0.00	149	2.26	902	13.67	1346	20.39

FIGURE 5



large M factor, a few individuals can produce a noticeable effect on the overall group mean for M teeth.

In the female there was a tendency towards a reduction in the numbers of untreated lesions from 15 through to 21 years so the dental care coverage would seem to be more adequate in the female than the male. However, that some deterioration of dental fitness may have been occurring in the female was indicated by the fact that increasing numbers of decayed teeth were being treated by extraction rather than by restoration; again the marked effect of a few edentulous subjects on the overall group means must be remembered.

A useful means of assessing the adequacy of dental treatment is to express the numbers of filled teeth as a percentage of total DMF teeth. Obviously the closer this approaches 100 per cent the more adequate a treatment service is being provided. This ratio for the male and female subjects in this survey is shown in Table 9 and in Figure 6. Two major facts emerged from these data. Firstly, the superiority of the female over the male in the maintenance of dental health was again demonstrated. Secondly, as measured by this index, no great deterioration in dental health was occurring in this age group. In fact in the twentieth and twenty-first year standards of dental fitness seemed to improve, as indicated by the upward slopes of the graphs (Figure 6) at these points.

The percentage of DMF teeth that are missing or require extraction is an alternative means of gauging the efficacy of dental treatment. As may be seen in Table 10, the differences in these ratios between the sexes were very slight and data for the sexes have been pooled in Figure 7. The increase in this ratio over the age span 15 to 21 years has been visually somewhat exaggerated in Figure 7 due to the truncated ordinate, with a break from 20 per cent to 85 per cent. In 15 year olds, 1.8 per cent of the DMF teeth were actually missing or required extraction; by age twenty-one this percentage had increased to 11.1.

(d) DMF Surfaces

Caries data expressed by the DMF surfaces index are shown in Table 11. These data, unlike those of the Modified Bodecker Dental Caries Index, are based on the United States Public Health Service convention of five surfaces for all teeth. The total number of surfaces normally present (i.e., the number of surfaces actually present plus surfaces on teeth extracted because of dental caries) are included in Table 11 to permit the calculation of the DMF surfaces per 100 surfaces ratios. Little additional information on caries prevalence emerges in Table 11, and it is included merely for the sake of completeness and to allow comparisons with the published work of others who used the DMF surfaces index.

3.5 The Dental Services Index

This new index, designed to measure the amount of dental manpower required to make a population dentally fit and therefore, indirectly, to measure the magnitude of current and back-log dental care needs, has been found to be quite a useful one. Results are shown both as a frequency distribution in 17 classes of indices with a class interval of 500 (Table 12) and the mean indices (Table 13 and Figure 8). The standard of dental fitness of the 15 to 21 year old population is good but not as good as the younger population enrolled under General Dental Benefits. It has been reported by the Department of Health (16) that in 1963, 189,529 children were enrolled for general dental benefits and that the average cost of the 292,569 completed courses of treatment received by these children was £3.16s.7d. (NZ\$7.66), giving a dental services index for

TABLE 9 : THE RATIO F:DMF PER CENT

The percentage of the total DMF teeth that were filled and were not secondarily carious, presented age specific and sex specific and pooled

Sex	Age in years	Number of subjects	Total number of filled teeth F	Total number of decayed, missing and filled teeth DMF	The percentage of decayed, missing and filled teeth that were filled F:DMF %
MALE	15	158	1451	2616	55.5
	16	233	2444	4176	58.5
	17	207	2028	3848	52.7
	18	231	2433	4567	53.3
	19	148	1490	2914	51.1
	20	124	1410	2528	55.8
	21	39	479	772	62.0
FEMALE	15	135	1467	2444	60.0
	16	199	2187	3659	59.8
	17	239	2791	4511	61.9
	18	166	1907	3124	61.0
	19	140	1668	2641	63.2
	20	99	1256	1917	65.5
	21	27	423	574	73.7
MALE + FEMALE	15	293	2918	5060	57.7
	16	432	4631	7835	59.1
	17	446	4819	8359	57.7
	18	397	4340	7691	56.4
	19	288	3158	5555	56.8
	20	223	2666	4445	59.9
	21	66	902	1346	67.0

TABLE 10 : THE RATIO MX:DMF PER CENT

The percentage of the total DMF teeth that were either missing or required extraction, presented age specific and sex specific and pooled

Sex	Age in years	Number of subjects	Total number of missing teeth M	Total number of teeth requiring extraction X	Total number of teeth either missing or requiring extraction MX	Total number of decayed, missing and filled teeth DMF	The percentage of DMF teeth either missing or requiring extraction MX:DMF %	48	
MALE	15	158	56	13	69	2616	2.6		
	16	233	106	41	147	4176	3.5		
	17	207	102	106	208	3848	5.4		
	18	231	316	106	422	4567	9.2		
	19	148	165	28	193	2914	6.6		
	20	124	197	49	246	2528	9.7		
	21	39	109	0	109	772	14.1		
FEMALE	15	135	19	1	20	2444	0.8		
	16	199	113	10	123	3659	3.4		
	17	239	230	8	238	4511	5.3		
	18	166	247	25	272	3124	8.7		
	19	140	184	9	193	2641	7.3		
	20	99	139	57	196	1917	10.2		
	21	27	40	0	40	574	6.9		
MALE AND FEMALE	15	293	75	14	89	5060	1.8		
	16	432	219	51	270	7835	3.4		
	17	446	332	114	446	8359	5.3		
	18	397	563	131	694	7691	9.0		
	19	288	349	37	386	5555	6.9		
	20	223	336	106	442	4445	9.9		
	21	66	149	0		1346	11.1		

TABLE 11 : DMF SURFACES INDEX

Dental caries prevalence among the New Zealand population aged 15 to 21, age specific, and sex specific and pooled, expressed by the DMFS index (modified): the numbers of decayed surfaces, surfaces on decayed teeth requiring extraction, surfaces on teeth extracted because of dental caries, filled surfaces, and the summation of each of these categories, the DMFS. Data presented both for the total numbers of surfaces in the group, and the mean per subject.

Sex	Age in years	Number of subjects	Number of surfaces normally present	Number of decayed surfaces		Number of surfaces on decayed teeth requiring extraction		Number of surfaces on teeth extracted because of dental caries		Number of filled surfaces		Number of decayed, missing and filled, surfaces	
				Total	Mean	Total	Mean	Total	Mean	F	Total	Total	Mean
MALE	15	158	21775	137.82	1370	8.67	65	0.41	280	1.77	4528	28.66	6243
	16	233	32380	138.97	1918	8.23	205	0.88	530	2.28	7614	32.68	10267
	17	207	29290	141.49	1939	9.37	530	2.56	510	2.46	6628	32.02	9607
	18	231	33130	143.42	2148	9.29	530	2.29	1580	6.84	7593	32.87	11851
	19	148	21525	145.44	1508	10.19	140	0.95	825	5.57	4889	33.03	7362
	20	124	18345	147.94	1066	8.59	245	1.98	985	7.94	4422	35.66	6718
	21	39	5875	150.64	209	5.36	0	0.00	545	13.97	1356	34.77	2110
FEMALE	15	135	18310	135.63	1181	8.75	5	0.04	95	0.70	4766	35.30	6047
	16	199	27580	138.59	1638	8.23	50	0.25	565	2.84	6521	32.77	874
	17	239	33555	140.39	1772	7.41	40	0.17	1150	4.81	8497	35.55	11459
	18	166	23575	142.02	1095	6.59	125	0.75	1235	7.44	5819	35.05	8274
	19	140	20085	143.46	931	6.65	45	0.32	920	6.57	5041	36.01	6937
	20	99	14425	145.71	530	5.35	285	2.88	695	7.02	3688	37.25	5198
	21	27	3905	144.63	127	4.70	0	0.00	200	7.41	1211	44.85	1538
MALE + FEMALE	15	293	40085	136.81	2551	8.71	70	0.24	375	1.28	9294	31.72	12290
	16	432	59960	138.79	3556	8.23	255	0.59	1095	2.53	14135	32.72	19041
	17	446	62845	140.91	3711	8.32	570	1.28	1660	3.72	15125	33.91	21066
	18	397	56705	142.83	3243	8.17	655	1.65	2815	7.09	13412	33.78	20125
	19	288	41610	144.48	2439	8.47	185	0.64	1745	6.06	9930	34.48	14299
FEMALE	20	223	32770	146.95	1596	7.16	530	2.38	1680	7.53	8110	36.37	11916
	21	66	9780	148.18	336	5.09	0	0.00	745	11.29	2567	38.89	3648

TABLE 12 : FREQUENCY DISTRIBUTION, DENTAL SERVICES INDEX

The numbers of subjects (frequency) in each of 17 classes (class interval = 500) of dental services indices:
 Age specific and sex specific and pooled

Sex	Age in years	Number of subjects	FREQUENCY OF DENTAL SERVICES INDICES OF:															
			0 to 495	500 to 995	1000 to 1495	1500 to 1995	2000 to 2495	2500 to 2995	3000 to 3495	3500 to 3995	4000 to 4495	4500 to 4995	5000 to 5495	5500 to 5995	6000 to 6495	6500 to 6995	7000 to 7495	7500 to 7995
MALE	15	158	14	36	31	29	13	16	8	4	2	0	2	3	1	0	0	0
	16	233	25	48	45	36	27	23	14	9	5	3	2	2	1	0	0	1
	17	207	14	23	42	42	34	15	16	8	5	2	2	0	2	0	0	0
	18	231	21	31	48	44	25	26	12	8	5	2	1	2	0	1	0	1
	19	148	13	14	23	29	24	15	10	6	7	2	0	0	1	0	0	0
	20	124	9	25	22	22	15	15	5	1	0	3	0	0	0	0	0	0
FEMALE	21	39	5	14	9	7	2	0	1	0	0	0	0	0	0	0	0	0
	15	135	13	24	30	19	16	13	6	8	1	1	1	1	2	0	0	0
	16	199	20	44	38	32	24	18	4	6	5	3	2	0	0	1	0	1
	17	239	27	45	58	45	27	19	5	6	3	2	0	1	0	0	0	0
	18	166	27	38	34	24	23	9	4	4	2	3	0	0	0	0	0	0
	19	140	22	35	33	14	19	5	1	2	1	0	0	0	0	0	0	0
MALE AND FEMALE	20	99	20	21	27	10	14	3	2	0	1	0	0	0	0	0	0	0
	21	27	7	6	4	7	0	0	0	0	0	0	0	0	0	0	0	0
	15	293	27	60	61	48	29	29	14	12	3	1	3	4	1	0	0	0
	16	432	45	92	83	68	51	41	18	15	3	2	3	2	1	1	0	1
	17	446	41	68	100	87	61	34	21	14	8	5	4	0	2	0	1	0
	18	397	48	69	82	68	48	35	16	9	7	6	4	2	1	1	0	1
FEMALE	19	288	35	49	56	43	20	14	18	6	5	4	0	3	0	0	0	0
	20	223	29	46	32	29	22	13	2	1	0	0	0	0	0	0	0	0
FEMALE	21	66	12	20	13	12	11	10	9	8	7	6	5	4	3	0	0	0

TABLE 13 : MEAN DENTAL SERVICES INDEX

Mean Dental Services Indices expressed age specific and sex specific and pooled.

SEX	Age in years	Number of subjects	Mean Dental Services Index
MALE	15	158	1707
	16	233	1712
	17	207	1961
	18	231	1939
	19	148	2111
	20	124	1809
	21	39	1223
FEMALE	15	135	1813
	16	199	1744
	17	239	1580
	18	166	1447
	19	140	1470
	20	99	1303
	21	27	1201
MALE + FEMALE	15	293	1756
	16	432	1727
	17	446	1757
	18	397	1733
	19	288	1799
	20	223	1584
	21	66	1214

FIGURE 6

**PERCENTAGE OF D.M.F. TEETH FILLED
IN THE NEW ZEALAND POPULATION
AGED 15 TO 21 - 1962-64**

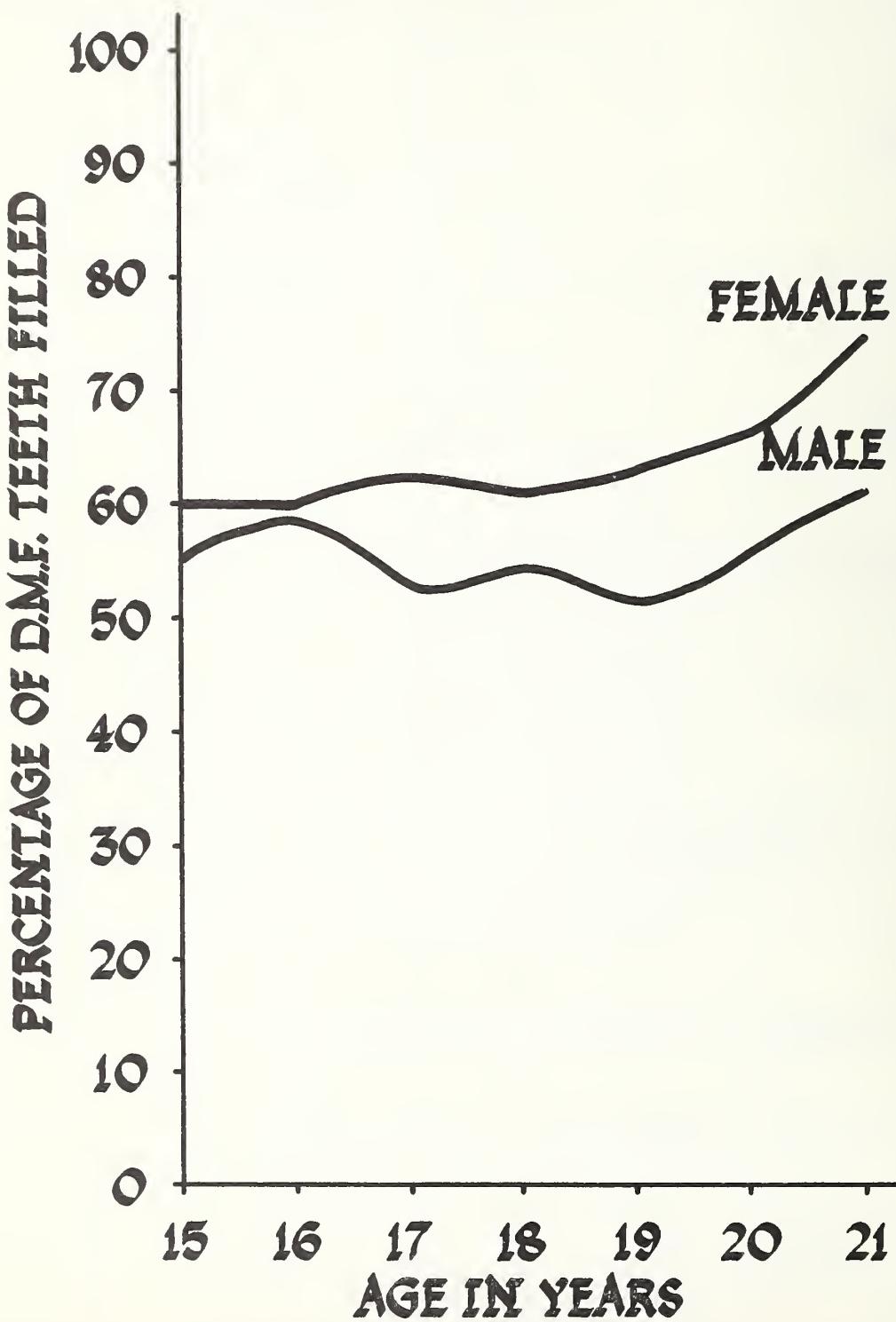
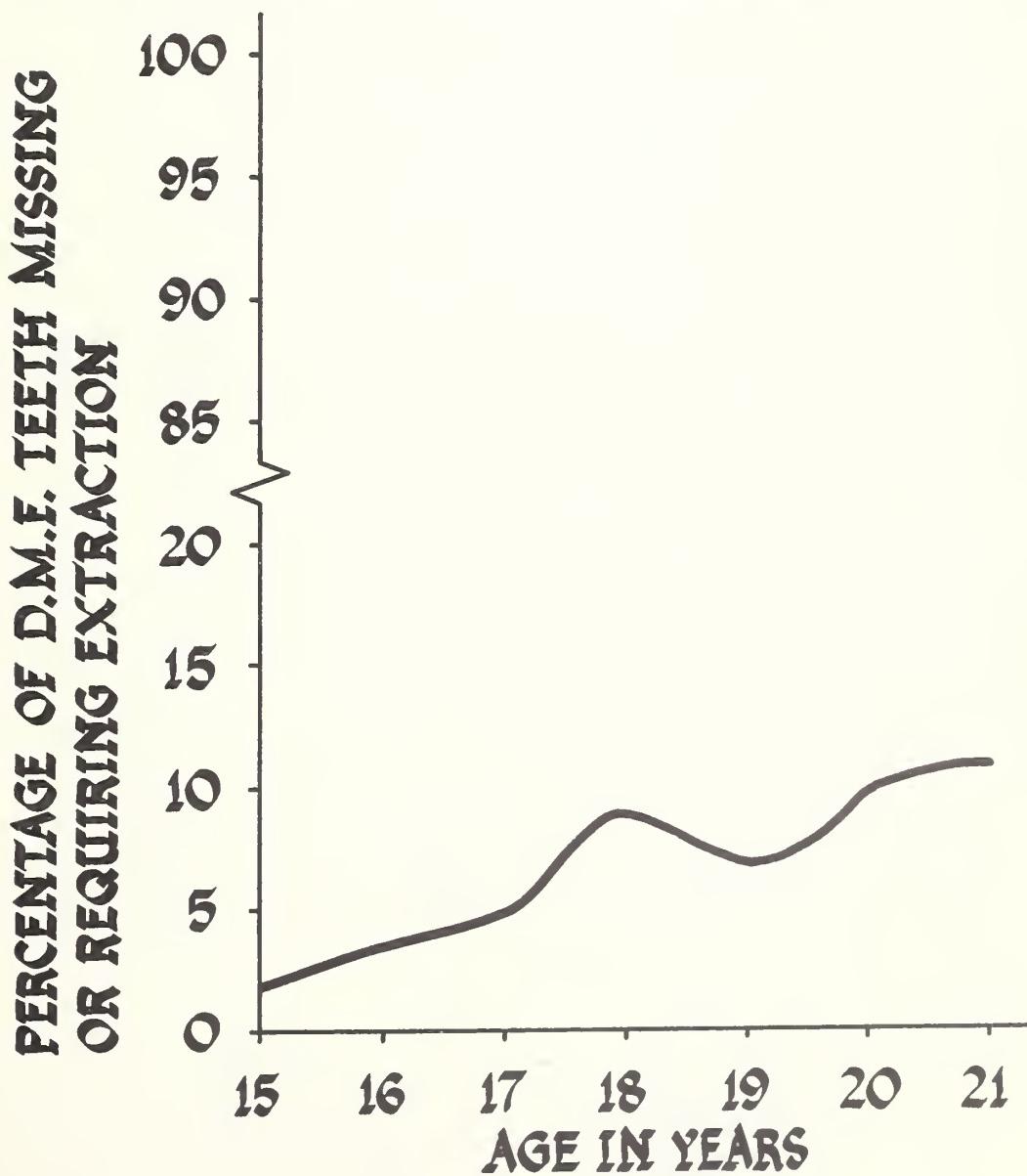


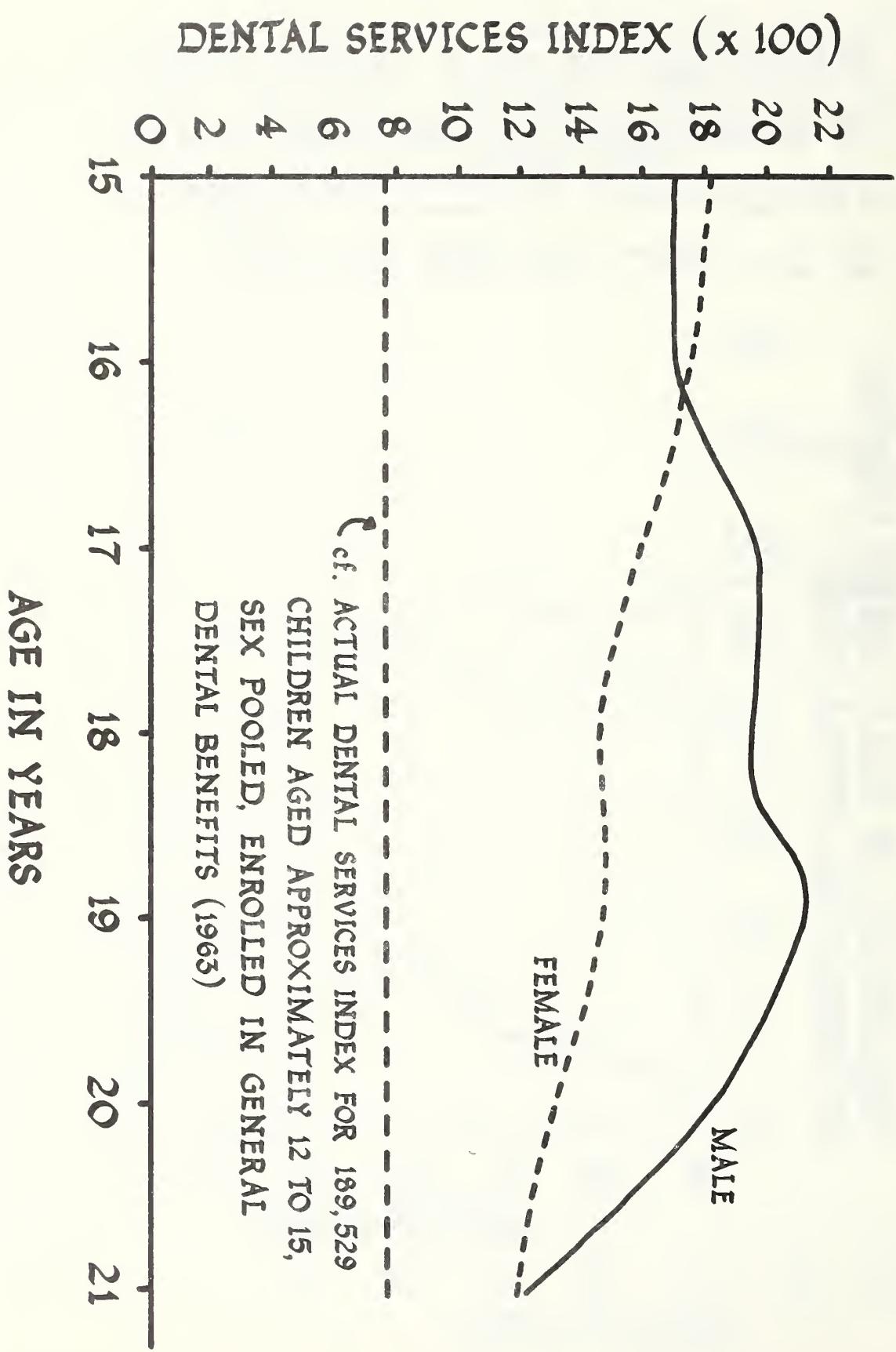
FIGURE 7

**PERCENTAGE OF D.M.F. TEETH MISSING
OR REQUIRING EXTRACTION IN THE
NEW ZEALAND POPULATION AGED 15
TO 21 - 1962 - 64 (SEX POOLED)**



DENTAL SERVICES INDICES OF THE MALE & FEMALE NEW
ZEALAND POPULATION AGED 15 TO 21 - 1962-64

FIGURE 8



these children of 766. This value is shown for comparison purposes in Figure 8. It can be seen in this figure that, very roughly, twice as much dental service would be required to achieve dental fitness in the 15 to 21 year old group as in the general dental benefits group. This level of dental neglect in the former group is by no means gross, but room for improvement exists.

The age group of 15 years in this survey over-laps with the upper age limit of the general dental benefits group. The reason for the disparity between the dental services index for this group in the survey (1756) and the index actually recorded in the general dental benefits scheme (766) is that the survey included a random sample of 15 year olds, some of whom, on an age basis, were eligible for enrolment in general dental benefits but were in fact not enrolled. The dental services index of those not enrolled would be higher than those enrolled and this would produce an upward movement of the index of the whole group. In addition, the General Dental Benefits index of 766 is based on a great many children under the age of 15, as well as 15 year olds.

A comparison of the two sexes, shown in Table 13 and Figure 8, is of interest. In the case of the female it is most encouraging to see the consistent downward slope of the graph. As has been already determined in the DMF teeth index from the age of 15 onward the high annual caries attack rate of earlier years has very largely abated. Dental care would therefore seem in the female to be essentially maintenance care after 15 years, with a relatively small number of new lesions to be repaired. If this maintenance care is being provided, a year by year reduction in the dental services index can be expected. The reduction actually recorded in this services index indicates that the female is receiving a quite good maintenance service. The only disturbing feature is that, despite the downward slope of the graph, the whole graph is set at a rather high level compared with the index (and therefore the standard of dental fitness) of younger children enrolled for general dental benefits.

The upward slope of the graph for the male from ages 15 to 19 indicates a slight but definite decrease in the standard of dental fitness. The dental care needs of this group represent a combination of current and back-log needs, for the DMF teeth index shows a continuing high annual attack rate in the male during these years. In the younger age groups a similarly high annual attack rate does not result in such a high, and increasing, dental services index for those enrolled in general dental benefits. It must therefore be concluded that past 15 years, there is a mild, significant reduction in the adequacy of dental care coverage for the male population.

As this survey is the first occasion on which the dental services index has been used, there are obviously no comparable data from other countries. No comment can therefore be made on the standard of dental fitness of the youth of New Zealand compared with other countries. The only general comment the reported data allow is that neglect of dental health following the cessation of general dental benefits could certainly not be described as gross, but room does exist for improvement, particularly in the male.

3.6 Oral Hygiene Index

Table 14 and Figure 9 present the oral hygiene findings from the survey based on the Oral Hygiene Index of Greene and Vermillion (10). A sex difference is apparent in the oral debris indices, the scores for the males being quite markedly higher than those for the females at all age groups except 21 years where the small sample sizes may have obscured the result. The calculus indices show a very much less noticeable tendency for higher scores in the males.

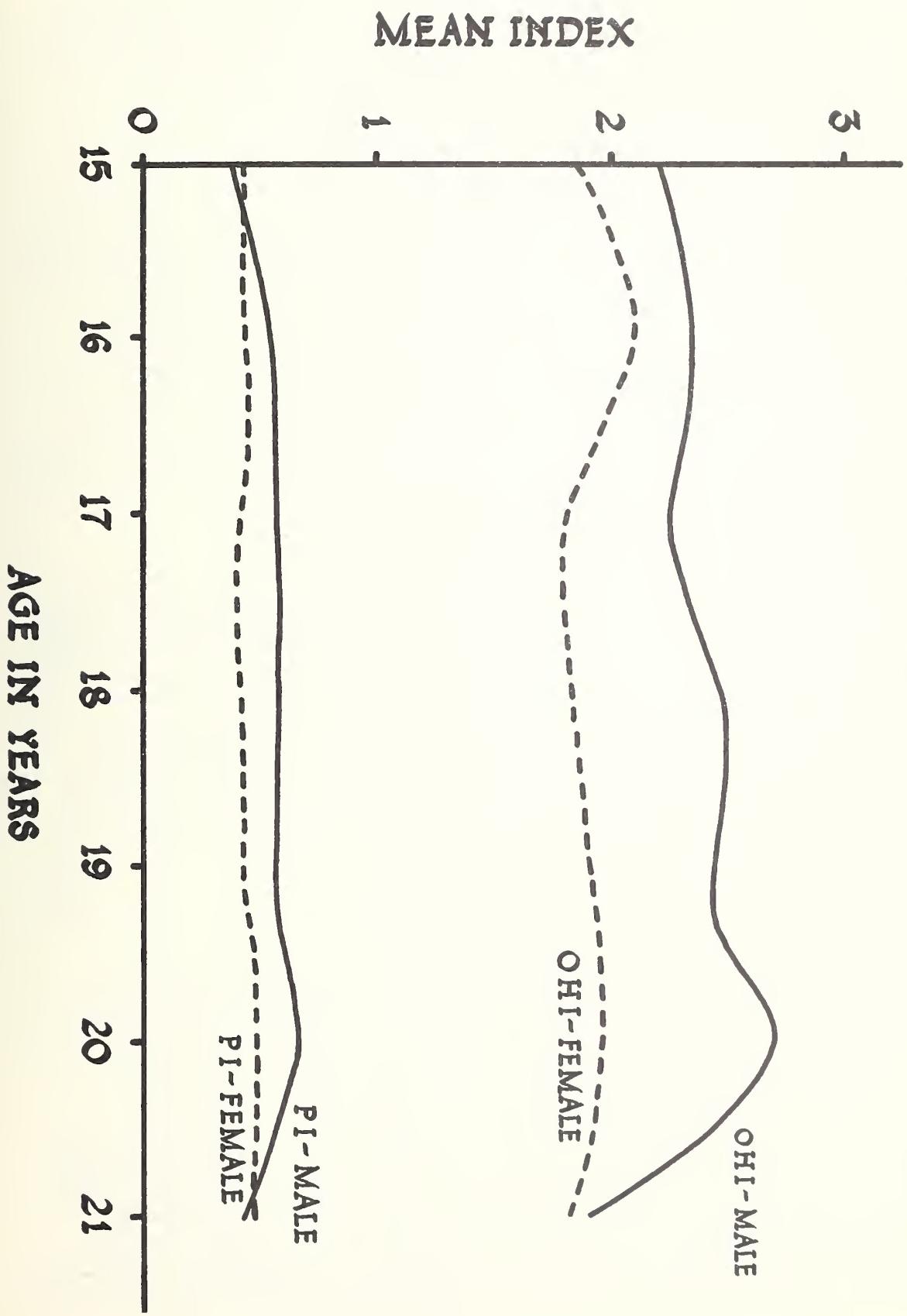
TABLE 14 : ORAL HYGIENE INDEX

Greene and Vermillion Oral Debris Indices, Calculus Indices, and the sum of these two, the Oral Hygiene Indices. Age specific and sex specific and pooled. The number of subjects does not include the totally edentulous nor the subjects in the pilot study to the main survey where the Greene and Vermillion Index was not used.

Sex	Age in years	Number of subjects	Mean Oral Debris Index	Mean Calculus Index	Mean Oral Hygiene Index
MALE	15	158	2.05	0.16	2.21
	16	221	2.13	0.21	2.34
	17	189	1.95	0.29	2.24
	18	189	2.17	0.29	2.46
	19	133	2.14	0.29	2.43
	20	105	2.29	0.41	2.70
	21	27	1.61	0.29	1.90
FEMALE	15	133	1.69	0.16	1.85
	16	178	1.87	0.22	2.09
	17	216	1.63	0.19	1.82
	18	147	1.62	0.21	1.83
	19	113	1.67	0.24	1.91
	20	83	1.69	0.27	1.96
	21	24	1.60	0.22	1.82
MALE AND FEMALE	15	291	1.88	0.16	2.04
	16	399	2.01	0.21	2.22
	17	405	1.78	0.23	2.01
	18	336	1.93	0.25	2.18
	19	246	1.93	0.27	2.20
	20	188	2.03	0.35	2.38
	21	51	1.60	0.26	1.86

ORAL HYGIENE INDICES AND PERIODONTAL INDICES OF THE MALE
& FEMALE NEW ZEALAND POPULATION AGED 15 TO 21 - 1962-64

FIGURE 9



In view of the poorer standards of oral hygiene noted in the male during examination it was of interest to determine if any sex difference could be demonstrated in the frequency of toothbrushing. This information, shown in Table 15, certainly suggested a sex difference did exist in frequency of toothbrushing, with the male reporting a considerably less frequent use of the toothbrush. To demonstrate this difference more clearly the data of Table 15 were simplified by pooling the groups who reported they used the toothbrush never, seldom and daily into a group who brushed their teeth once a day or less, and pooling the groups who brushed their teeth twice and three times a day into a group who brushed their teeth more than once a day. These simplified figures are presented in Table 16. The males are shown here to have very much inferior oral hygiene practices to the females. Some caution is called for in interpreting these results because of the questionable manner in which the information was collected. It is probably extremely difficult to obtain a reliable answer to the question "how many times a day do you brush your teeth?" In his amusing but factual book with the satirical title "How to Lie with Statistics", Huff (17) says "..... the next time you learn from your reading that the average Americanbrushes his teeth 1.02 times a day - a figure I have just made up, but it may be as good as anyone else's - ask yourself a question. How can anyone have found out such a thing?" The observed sex difference in toothbrushing habits could well be explained by the fact that a young man is more willing to tell a dentist the truth about his toothbrushing than is a young woman. Nevertheless, the figures are still suggestive of a true sex difference in home dental care particularly in view of the difference observed clinically in the results of home care and the standards of oral cleanliness.

3.7 Russell Periodontal Index

The periodontal indices recorded in this survey are shown in Table 17 and Figure 9. Once again a sex difference has emerged with the males showing higher indices than the females at all age groups except 15 years and 21 years. The periodontal indices have been shown on the same graph (Figure 9) as the oral hygiene indices to demonstrate the positive association, reported by others (18, 19), between periodontal disease and standards of oral hygiene. The males with lower standards of oral hygiene (higher OHI) have a higher rate of periodontal disease (higher PI). The elevated periodontal indices in the male are more likely to result from the lower standards of oral hygiene than to be an inherent sex difference in the susceptibility to periodontal disease. As Greene (18) has observed "oral hygiene status rather than the individual's sex appears to be the more important variable with respect to the development of periodontal disease."

3.8 Prosthetics

Table 18 provides detailed information on the frequency of observing the various prosthetic codes, which were defined in section 2.2.4.6 above. The first figure in the code refers to the upper jaw and the second figure to the lower jaw. The many possible combinations of codes which do not appear in Table 18 were not observed at all during the survey. The data of Table 18 are simplified in Table 19 and Figure 10. This was done by pooling codes 0 and 1 into the group "subjects requiring full denture(s)", pooling codes 2,3 and 4 into "subjects wearing full denture(s)", pooling codes 5 and 6 into "subjects requiring partial denture(s)" and pooling codes 7, 8 and 9 into "subjects wearing partial denture(s)". In five out of the 115 subjects who were wearing or required denture(s) it was found that the condition in the maxilla would place them in one pooled group and the condition in the mandible would place them in another pooled group. To prevent double entry of these five subjects in the table, one of the two conditions was ignored and they were entered in just a single pooled group, according to the following two general rules (in the order given): (a) if the condition in one

TABLE 15 : FREQUENCY OF TOOTHBRUSHING

Frequency of toothbrushing, the information being obtained by questionnaire methods. Age specific and sex specific and pooled. The number of subjects does not include the totally edentulous nor the subjects in the pilot study to the main survey where this information was not obtained.

Sex	Age in years	Number of subjects	SUBJECTS WHO REPORTED THEY BRUSHED THEIR TEETH:									
			Never		Seldom		Daily		Twice daily		Three times daily	
			No.	%	No.	%	No.	%	No.	%	No.	%
MALE	15	158	2	1.3	15	9.5	71	44.9	63	39.9	7	4.4
	16	221	0	0.0	33	14.9	107	48.4	75	33.9	6	2.7
	17	189	1	0.5	26	13.8	79	41.8	77	40.7	6	3.2
	18	189	2	1.1	32	16.9	81	42.9	68	35.9	6	3.2
	19	133	1	0.8	16	12.0	60	45.1	55	41.4	1	0.8
	20	105	1	0.9	12	11.4	45	42.9	42	40.0	5	4.8
	21	27	0	0.0	1	3.7	11	40.7	12	44.4	3	11.1
FEMALE	15	133	0	0.0	3	2.3	27	20.3	91	68.4	12	9.0
	16	178	0	0.0	6	3.4	38	21.3	115	64.6	19	10.7
	17	216	0	0.0	4	1.9	38	17.6	143	66.2	31	14.4
	18	147	0	0.0	5	3.4	23	15.6	99	67.3	20	13.6
	19	113	0	0.0	1	0.9	19	16.8	81	71.7	12	10.6
	20	83	0	0.0	2	2.4	16	19.3	58	69.9	7	8.4
	21	24	0	0.0	0	0.0	4	16.7	17	70.8	3	12.5
MALE AND FEMALE	15	291	2	0.7	18	6.2	98	33.7	154	52.9	19	6.5
	16	399	0	0.0	39	9.8	145	36.3	190	47.6	25	6.3
	17	405	1	0.2	30	7.4	117	28.9	220	54.3	37	9.1
	18	336	2	0.6	37	11.0	104	30.9	167	49.7	26	7.7
	19	246	1	0.4	17	6.9	79	32.1	136	55.3	13	5.3
	20	188	1	0.5	14	7.4	61	32.4	100	53.2	12	6.4
	21	51	0	0.0	1	1.9	15	29.4	29	56.9	6	11.8

TABLE 16 : FREQUENCY OF TOOTHBRUSHING, SIMPLIFIED TABULATION

The data of Table 15 presented in a simpler tabulation to demonstrate the sex difference in the frequency of toothbrushing more clearly.

Sex	Age in years	Number of subjects	SUBJECTS WHO REPORTED THEY BRUSHED THEIR TEETH:			
			ONCE A DAY OR LESS		MORE THAN ONCE A DAY	
			Number	Per cent	Number	Per cent
MALE	15	158	88	55.7	70	44.3
	16	221	140	63.3	81	36.7
	17	189	106	56.1	83	43.9
	18	189	115	60.8	74	39.2
	19	133	77	57.9	56	42.1
	20	105	58	55.2	47	44.8
	21	27	12	44.4	15	55.6
FEMALE	15	133	30	22.6	103	77.4
	16	178	44	24.7	134	75.3
	17	216	42	19.4	174	80.6
	18	147	28	19.0	119	80.9
	19	113	20	17.7	93	82.3
	20	83	18	21.7	65	78.3
	21	24	4	16.7	20	83.3
MALE AND FEMALE	15	291	118	40.5	173	59.5
	16	399	184	46.1	215	53.9
	17	405	148	36.5	257	63.5
	18	336	143	42.6	193	57.4
	19	246	97	39.4	149	60.6
	20	188	76	40.4	112	59.6
	21	51	16	31.4	35	68.6

TABLE 17 : RUSSELL PERIODONTAL INDEX

Russell Periodontal Indices presented age specific and sex specific and pooled. The number of subjects does not include those subjects who were totally edentulous.

Sex	Age in years	Number of subjects	Russell Periodontal Index
MALE	15	158	0.38
	16	233	0.55
	17	206	0.58
	18	226	0.58
	19	147	0.58
	20	122	0.66
	21	37	0.43
FEMALE	15	135	0.43
	16	199	0.46
	17	237	0.42
	18	163	0.43
	19	140	0.43
	20	98	0.49
	21	27	0.46
MALE AND FEMALE	15	293	0.40
	16	432	0.51
	17	443	0.49
	18	389	0.52
	19	287	0.50
	20	220	0.58
	21	64	0.44

TABLE 18 : FREQUENCY DISTRIBUTION, PROSTHETIC CODES

The number of subjects (frequency) for which a prosthetic code was recorded, by codes. The first figure of the code refers to the upper jaw, the second figure of the code to the lower jaw. X = no prosthetic appliance worn or required. The codes are defined in the footnote below. Those combinations of codes not represented in the table were not recorded in the survey.

Sex	Age in years	Number of subjects	NUMBER OF SUBJECTS WITH PROSTHETIC CODES OF:																
			00	11	15	20	22	24	25	27	2X	55	5X	65	66	6X	7X	8X	X5
MALE	15	158	•	•	1	•	•	•	•	•	1	•	1	•	1	•	1	•	1
	16	233	•	•	1	•	1	•	•	•	1	1	1	•	2	•	•	•	1
	17	207	3	3	•	1	1	1	•	•	1	1	1	1	2	•	•	3	•
	18	231	•	•	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	19	148	•	•	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	20	124	•	•	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	21	39	•	•	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	15-21	1140	3	4	•	1	6	1	•	6	3	4	1	7	2	16	1	4	2
FEMALE	15	135	•	•	1	•	•	•	•	•	1	•	2	1	•	•	•	1	•
	16	199	•	•	1	•	1	•	•	•	1	1	2	•	•	2	•	2	•
	17	239	1	1	1	1	2	1	1	1	1	1	3	1	1	4	•	2	•
	18	166	1	1	1	1	2	1	1	1	1	1	3	1	1	3	•	2	•
	19	140	•	•	1	•	1	1	1	1	1	1	1	1	1	1	1	1	1
	20	99	•	•	1	•	1	1	1	1	1	1	1	1	1	1	1	1	1
	21	27	•	•	1	•	1	1	1	1	1	1	1	1	1	1	1	1	1
	15-21	1005	2	1	1	•	4	•	2	1	3	6	8	3	•	1	17	•	5
MALE and FEMALE	15	293	•	1	1	•	•	•	•	•	1	1	•	1	1	1	1	1	1
	16	432	1	4	1	1	2	1	1	1	1	1	2	2	2	2	2	2	1
	17	446	1	4	1	1	2	1	1	1	1	1	4	1	1	4	1	4	1
	18	397	4	4	1	1	2	1	1	1	1	1	4	1	1	3	1	3	1
	19	288	•	•	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1
	20	223	•	•	1	1	1	1	1	1	1	1	4	1	1	1	1	1	1
	21	66	•	•	1	1	2	1	1	1	1	1	4	1	1	1	1	1	1
	15-21	2145	5	5	1	1	10	1	2	1	9	9	12	4	7	3	33	1	9
																		2	

- 0 - Edentulous - new full denture required
- 1 - Full clearance required - new full denture required
- 2 - Wearing full denture - satisfactory
- 3 - Wearing full denture - replacement required
- 4 - Wearing full denture - repair or remake required

- 5 - Partially edentulous - new partial denture required
- 6 - Extractions required - new partial denture required
- 7 - Wearing partial denture - satisfactory
- 8 - Wearing partial denture - replacement required
- 9 - Wearing partial denture - repair or remake required

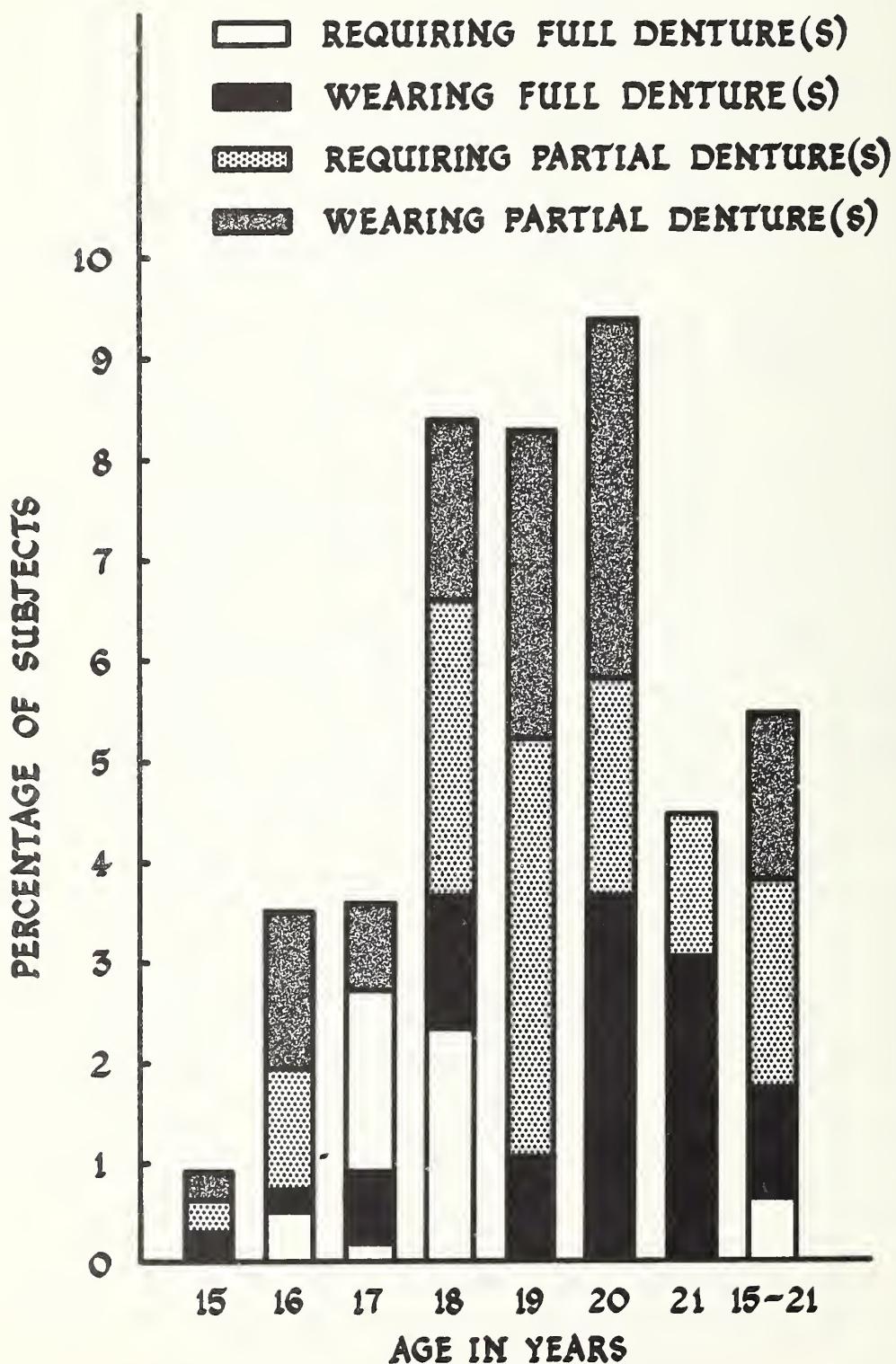
TABLE 19 : PROSTHETIC APPLIANCES WORN OR REQUIRED

The number and percentage of subjects requiring full denture(s), wearing full denture(s), requiring partial denture(s), wearing partial denture(s) and the overall number wearing or requiring full or partial denture(s). Age and sex specific and pooled.

Sex	Age in years	Number of subjects	Subjects requiring full denture(s)		Subjects wearing full denture(s)		Subjects requiring partial denture(s)		Subjects wearing partial denture(s)		Subjects wearing full or partial denture(s).	
			Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
MALE	15	158	0	0.0	1	0.6	1	0.6	1	0.6	3	1.9
	16	233	1	0.4	0	0.00	1	0.4	5	2.1	7	3.0
	17	207	0	0.0	2	0.9	3	1.4	0	0.00	5	2.4
	18	231	7	3.0	2	0.9	8	3.5	4	1.7	21	9.1
	19	148	0	0.0	2	1.4	5	3.4	4	2.7	11	7.4
	20	124	0	0.0	4	3.2	2	1.6	5	4.0	11	8.9
	21	39	0	0.00	2	5.1	1	2.6	0	0.0	3	7.7
FEMALE	15-21	1140	8	0.7	13	1.1	21	1.8	19	1.7	61	5.4
	15	135	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	16	199	1	0.5	1	0.5	4	2.0	2	1.0	8	4.0
	17	239	1	0.4	1	0.4	5	2.1	4	1.7	11	4.6
	18	166	2	1.2	3	1.8	4	2.4	3	1.8	12	7.2
	19	140	0	0.0	1	0.7	7	5.0	5	3.6	13	9.3
	20	99	0	0.0	4	4.0	3	3.0	3	3.0	10	10.1
MALE AND FEMALE	21	27	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	15-21	1005	4	0.4	10	0.9	23	2.3	17	1.7	54	5.4
	15	293	0	0.0	1	0.3	1	0.3	1	0.3	3	1.0
	16	432	2	0.5	1	0.2	5	1.2	7	1.6	15	3.5
	17	446	1	0.2	3	0.7	8	1.8	4	0.9	16	3.6
	18	397	9	2.3	5	1.3	12	3.0	7	1.8	33	8.3
	19	288	0	0.00	3	1.0	12	4.2	9	3.1	24	8.3
FEMALE	20	223	0	0.0	8	3.6	5	2.2	8	3.6	21	9.4
	21	56	0	0.0	2	3.0	1	1.5	0	0.0	3	4.5
MALE AND FEMALE	15-21	2145	12	0.6	23	1.1	44	2.1	36	1.7	115	5.4

FIGURE 10

PERCENTAGE OF NEW ZEALAND POPULATION
AGED 15 TO 21 REQUIRING OR WEARING FULL
OR PARTIAL DENTURES - 1962-64



jaw involved a full denture and the condition in the other a partial denture, the subject was classified in the full denture group; (b) if the condition in one jaw involved a denture requirement and the condition in the other jaw involved the wearing of a denture, the subject was classified in the requirement group.

As may be seen in Table 19 and Figure 10 the prevalence of dentures, either worn or needed, is quite low in this age group. Among the total age-sex pooled sample of 2145 subjects, 5.4 per cent were found to be wearing or requiring denture(s). In 80 subjects partial denture(s) were involved and in only 35 subjects were full denture(s) involved. Sampling errors may possibly have affected these observations. As mentioned in section 2.1, it was noticed during the initial phases of the survey that there was a tendency for the edentulous subject to think he need not attend for dental examination because he had no teeth. The measures taken to overcome this problem, by impressing on employers and employees that the survey team wished to see all employees 21 years of age and under, teeth or no, have probably reduced this sampling error to insignificant proportions.

The figures in the body of Table 19 are intrinsically somewhat unreliable as, from a reasonably small sample an attempt is being made to measure percentage prevalence of a very low order. Very much larger sample sizes would be required to establish these small percentages with any degree of certainty. Major attention should therefore be paid to the age-sex pooled figures where the percentages are based on a sample size of 2145.

Davies (14) has reported a reduction in the prevalence of denture wearing in New Zealanders aged 18 to 21 between the years of 1952 and 1958. These data, based on the examination of compulsory military training recruits, are sufficiently similar in nature to those of the present study to allow an examination of whether this downward trend between 1952 and 1958 continued until 1962-64. This comparison is shown in Figure 11. A most encouraging continued decrease in the prevalence of denture wearing is demonstrated.

3.9 Fractured Anterior Teeth

A total of 201 subjects (9.4 per cent) were found to have suffered one or more fractured anterior teeth. The sex distribution of the subjects involved confirms the clinical impression that has been reported by others (12) - males are very much more susceptible to this type of trauma than females. This distribution is shown in Table 20. The percentage of subjects who had received some form of treatment for their traumatised teeth is shown in Table 21. Females received rather better treatment coverage than males, and in both sexes combined 43 per cent of subjects had apparently received no treatment. However, an inspection of the full frequency distribution (not reproduced here) demonstrates that nearly all of the apparently untreated fractures were Ellis Class 1 (simple fracture involving little or no dentine) or Ellis Class 2 (fracture involving considerable dentine but not the pulp). In many of these cases the dentist may have elected to treat the tooth simply by smoothing any sharp enamel edges. Any such intervention would not be obvious in most cases to the present examiner, and such cases may have been classified as untreated.

Table 22 introduces the actual number of fractured anterior teeth found in the survey (262), and in Table 23 the distribution of these 262 teeth between the six tooth types (upper central and lateral incisor, upper canine, lower central and lateral incisor and lower canine), is given. These data are illustrated in Figure 12. The very high susceptibility of the upper central incisor compared with the other tooth types is apparent. This distributional pattern is similar to that reported by Ellis (12).

TABLE 20 : PREVALENCE OF FRACTURED ANTERIOR TEETH

The number and percentage of subjects with fractured anterior teeth. Age and sex specific and pooled.

Sex	Number of subjects	Subjects with fractured anterior teeth	
		Number	Per cent
MALE	1140	147	12.9
FEMALE	1005	54	5.4
MALE + FEMALE	2145	201	9.4

TABLE 21 : TREATMENT OF FRACTURED ANTERIOR TEETH

The number and percentage of subjects where the fractured anterior teeth had been, and had not been treated. Age and sex specific and pooled.

Sex	Number of subjects with fractured anterior teeth	Subjects with fractured anterior teeth that had been treated		Subjects with fractured anterior teeth that had not been treated	
		Number	Per cent	Number	Per cent
MALE	147	80	54.4	67	45.6
FEMALE	54	35	64.8	19	35.2
MALE + FEMALE	201	115	57.2	86	42.8

TABLE 22 : FRACTURED ANTERIOR TEETH PER SUBJECT INVOLVED

Age pooled and sex specific and pooled

Sex	Number of subjects with fractured anterior teeth	Total number of fractured anterior teeth	Mean number of fractured anterior teeth per subject
MALE	147	189	1.29
FEMALE	54	73	1.35
MALE + FEMALE	201	262	1.30

TABLE 23 : FRACTURED ANTERIOR TEETH BY TOOTH TYPE

Frequency distribution of 262 fractured anterior teeth by tooth type (upper central and lateral incisors, upper canines, lower central and lateral incisors, lower canines). Age pooled and sex specific and pooled.

Sex	NUMBER OF FRACTURED;						Total number of fractured anterior teeth	
	UPPER			LOWER				
	Central incisors	Lateral incisors	Canines	Central incisors	Lateral incisors	Canines		
MALE	129	18	1	21	18	2	189	
FEMALE	53	8	1	7	3	1	73	
MALE + FEMALE	182	26	2	28	21	3	262	

FIGURE 11

PERCENTAGE OF SAMPLES OF NEW ZEALAND
POPULATION AGED 18 - 21 WEARING OR RE-
QUIRING DENTURE(S) - 1952, 1958 AND 1962-64

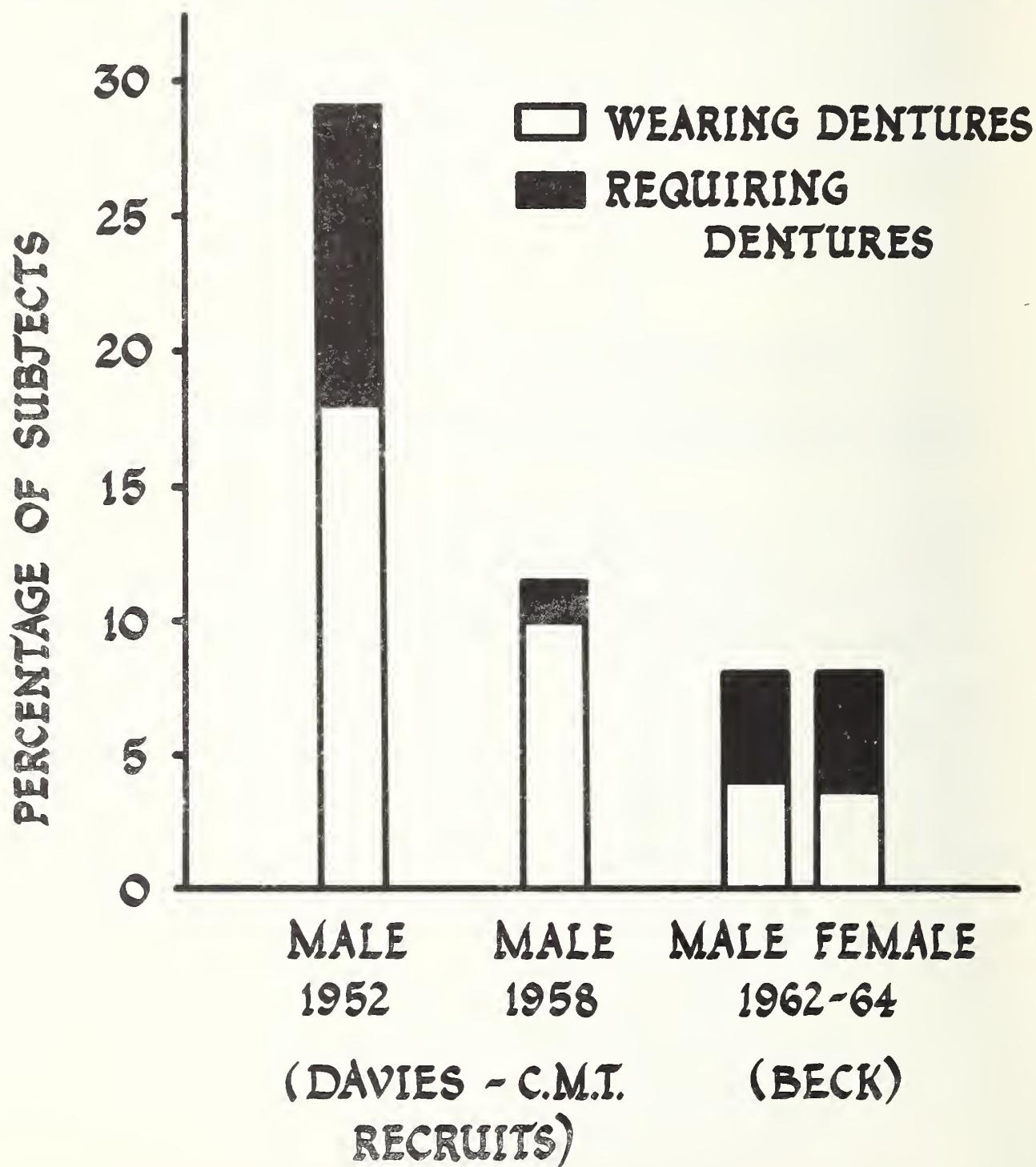
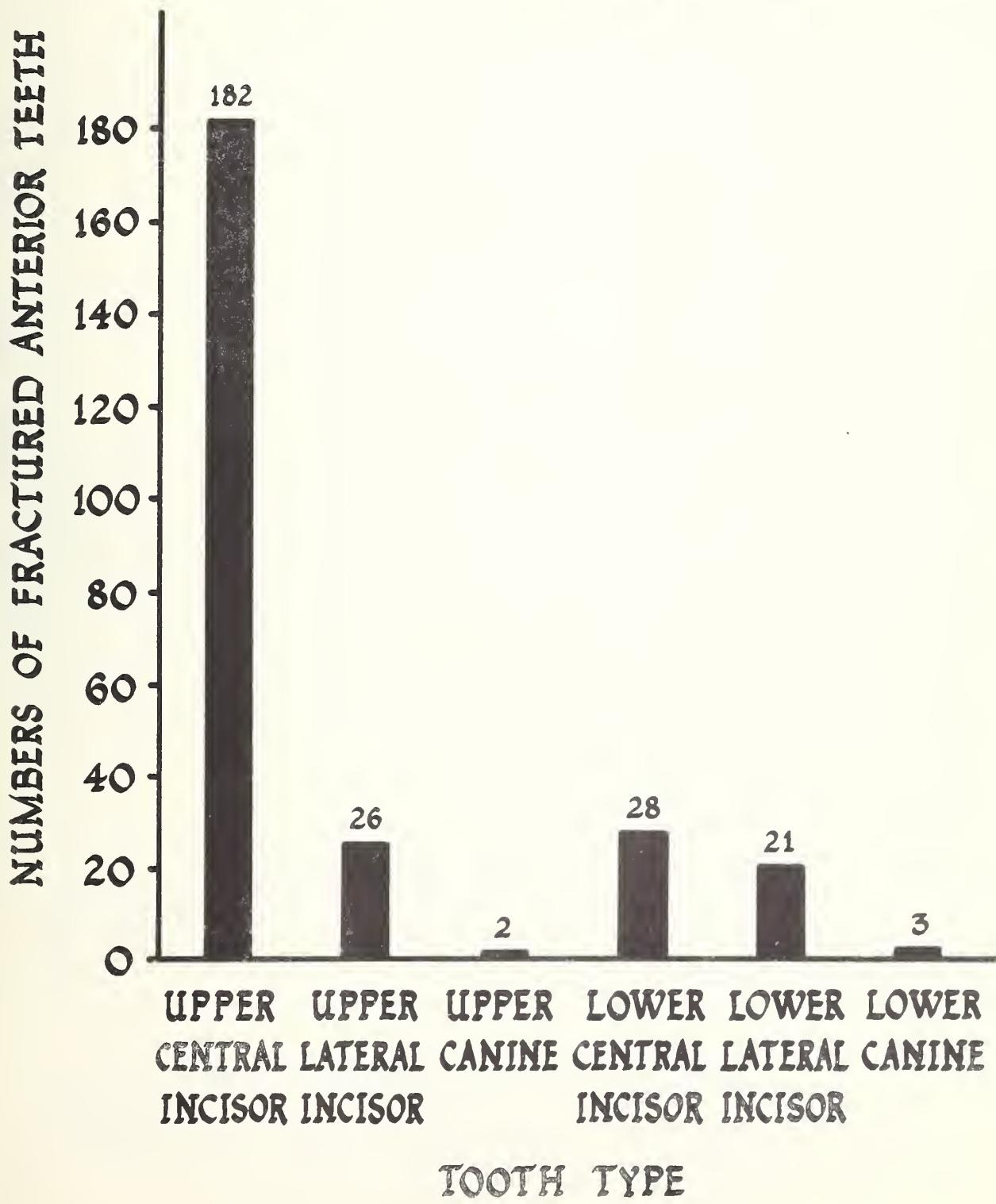


FIGURE 12

HISTOGRAM SHOWING FREQUENCY DISTRIBUTION
OF 262 FRACTURED ANTERIOR TEETH BY TOOTH
TYPE - AGE (15 TO 21 YEARS) AND SEX POOLED.



3.10 Descriptive Calculus Code

As described in section 2.2.4.8 above, the calculation of the prevalence of calculus deposits by the so-called Descriptive Calculus Code revealed that this code gave no information additional to that obtained by Greene and Vermillion's Calculus Index. Publication of the results of the Descriptive Calculus Code is therefore not warranted.

3.11 Enamel Opacities

The prevalence of enamel opacities, graded into the six scores developed for this survey, is shown in Table 24. No significant sex difference is apparent, the overall prevalence of approximately 22 per cent being very similar in the two sexes. By far the bulk of those affected by enamel opacity were affected to only a very limited degree - opacity score of 1.

3.12 Enamel Hypoplasia

Information on the prevalence of enamel hypoplasia is given in Table 25. Approximately seven per cent of males and ten per cent of females were affected. This difference is of borderline significance. As with enamel opacity, most of the affected subjects were affected to a reasonably mild degree, with scores of 1 and 3.

3.13 Oral Surgery Treatment Requirements

A total of 100 subjects (4.7 per cent) were found to require oral surgery other than simple exodontia. The nature of the condition and the number of subjects involved are shown in Table 26. It must be emphasised that a sizable error is inherent in the figures for impacted third molar teeth because specific radiography of the third molar regions was not undertaken in the survey. In some cases the bite-wing radiograph would include sufficient of the third molar region to allow a diagnosis of impacted third molars, while in other cases this region would not appear on the film at all. Almost certainly, therefore, our estimation of the prevalence of impacted third molars is an underestimation, for some cases will have been missed. The figures obtained in the survey were, however, considered worthy of reporting for they at least give an indication of the minimum prevalence of impacted third molars.

3.14 Handicapping Dento-facial Anomalies

The ruling of the WHO Expert Committee on Dental Health⁽⁶⁾ that handicapping dento-facial anomalies should only be specified and reported if treatment was considered necessary resulted in this age group, and in the present examiner's hands, in the finding of only a small number of cases - 12 cases (0.6 per cent) in all. Eleven of these were cases of crowding and the remaining one a severe case of amelogenesis imperfecta.

3.15 Other Conditions and Comments

Many and varied conditions were recorded under the heading of Other Conditions and Comments. However, most of these did not occur sufficiently frequently to warrant reporting. One or two of the more frequent or more interesting conditions will however be mentioned.

TABLE 24 : ENAMEL OPACITY

Frequency distribution of subjects with enamel opacities according to opacity scores. The scores are defined in the footnote below. No scores of 6 were recorded. Age and sex specific and pooled.

Sex	Age in years	Number of subjects	SUBJECTS WITH ENAMEL OPACITY SCORES OF:						Total number of subjects with enamel opacities		
			No.	%	No.	%	No.	%	No.	%	Number
MALE	15	158	25	15.8	1	0.6	3	1.9	2	1.3	0
	16	233	38	16.3	0	0.0	20	8.6	0	0.0	31
	17	207	29	14.0	0	0.0	9	4.3	0	0.4	59
	18	231	40	17.3	0	0.0	11	4.8	1	0.4	38
	19	148	27	18.2	0	0.0	8	5.4	0	0.0	52
	20	124	19	15.3	0	0.0	4	3.2	0	0.0	36
FEMALE	21	39	6	15.4	0	0.0	0	0.0	0	0.0	23
	15-21	1140	184	16.1	1	0.1	55	4.8	3	0.3	6
	15	135	26	19.3	0	0.0	9	6.7	0	0.0	245
	16	199	29	14.6	0	0.0	12	6.0	1	0.5	35
	17	239	47	19.7	0	0.0	14	5.9	0	0.0	46
	18	166	25	15.1	0	0.0	6	3.6	1	0.6	61
FEMALE	19	140	23	16.4	0	0.0	6	4.3	0	0.0	33
	20	99	8	8.1	0	0.0	4	4.0	0	0.0	30
	21	27	5	18.5	0	0.0	0	0.0	0	0.0	12
	15-21	1005	163	16.2	0	0.0	51	5.1	2	0.2	1
	15	293	51	17.4	1	0.3	12	4.1	2	0.7	222
	16	432	67	15.5	0	0.0	32	7.4	1	0.2	21.1
MALE AND FEMALE	17	446	76	17.0	0	0.0	23	5.2	0	0.0	105
	18	397	65	16.4	0	0.0	17	4.3	2	0.5	99
	19	288	50	17.4	0	0.0	14	4.9	0	0.3	85
	20	223	27	12.1	0	0.0	8	3.6	0	0.7	66
	21	66	11	16.7	0	0.0	0	0.0	0	0.0	35
	15-21	2145	347	16.2	1	0.0	106	4.9	5	0.2	11

- 1 - White opaque flecks, spots or patches involving less than 25 per cent of the surface area, and involving six teeth or less.
- 2 - Same as 1, but involving more than six teeth.
- 3 - White opaque flecks, spots or patches involving 25 to 50 per cent of the surface area, and involving six teeth or less.

- 4 - Same as 3, but involving more than 6 teeth.
- 5 - White opaque flecks, spots or patches involving more than 50 per cent of the surface area, and involving 6 teeth or less.
- 6 - Same as 5, but involving more than 6 teeth.

TABLE 25 : ENAMEL HYPOPLASIA

Frequency distribution of subjects with enamel hypoplasia according to hypoplasia scores. The scores are defined in the footnote below. Age and sex specific and pooled.

Sex	Age in years	Number of subjects	SUBJECTS WITH ENAMEL HYPOPLASIA SCORES OF:						Total number of subjects with enamel hypoplasia		
			1	2	3	4	5	6	No.	%	No.
MALE	15	158	7	4.4	0	0.0	1	0.6	0	0.0	2
	16	233	8	3.4	0	0.0	10	4.3	0	0.0	1
	17	207	6	2.9	0	0.0	7	3.4	0	0.0	1
	18	231	5	2.2	1	0.4	9	3.9	0	0.0	1
	19	148	8	5.4	0	0.0	5	3.4	0	0.0	1
	20	124	4	3.2	0	0.0	3	2.4	0	0.0	0
	21	39	2	5.1	0	0.0	0	0.0	0	0.0	0
15-21			1140	40	3.5	1	0.1	35	3.1	0	0.0
FEMALE	15	135	11	8.1	0	0.0	4	2.9	2	1.5	0
	16	199	9	4.5	0	0.0	7	3.5	0	0.5	1
	17	239	16	6.7	0	0.0	5	2.1	0	0.0	3
	18	166	7	4.2	0	0.0	5	3.0	1	0.6	2
	19	140	13	9.3	1	0.7	5	3.6	0	0.0	0
	20	99	4	4.0	0	0.0	1	1.0	0	0.0	1
	21	27	1	3.7	0	0.0	1	3.7	0	0.0	0
15-21			1005	61	6.1	1	0.1	28	2.8	3	0.3
MALE AND FEMALE	15	293	18	6.1	0	0.0	5	1.7	2	0.7	2
	16	432	17	3.9	0	0.0	17	3.9	0	0.0	1
	17	446	22	4.9	0	0.0	12	2.7	0	0.0	4
	18	397	12	3.0	1	0.3	14	3.5	1	0.3	3
	19	288	21	7.3	1	0.3	10	3.5	0	0.0	0
	20	223	8	3.6	0	0.0	4	1.8	0	0.0	1
	21	66	3	4.5	0	0.0	1	1.5	0	0.0	0
15-21			2145	101	4.7	2	0.1	63	2.9	3	0.1

1 - Part or whole of the enamel surface is rough but there is no evidence of pitting, and six teeth or less are involved.

2 - Same as 1, but with more than six teeth involved.

3 - The enamel surface is rough and there is pitting which involves less than 50 per cent of the surface area, and six teeth or less are involved.

4 - Same as 3, but with more than six teeth involved.

5 - The enamel surface is rough and there is pitting which involves more than 50 per cent of the surface area, and six teeth or less are involved.

6 - Same as 5, but with more than six teeth involved.

TABLE 26 : ORAL SURGERY TREATMENT REQUIREMENTS

The number of subjects requiring oral surgery other than simple exodontia, by condition. Age and sex pooled. (The need for simple exodontia, by numbers of teeth involved, is given in Table 8).

Condition	Number of subjects with stated condition	Number of teeth involved
Impacted third molar(s)	32	48
Impacted upper canine(s)	23	25
Impacted premolar(s)	14	19
Impacted upper lateral incisor	1	1
Mesioidens	14	-
Supernumerary teeth other than mesiodens	2	2
Retained fractured roots	9*	-
Retained deciduous teeth	3	3
Cysts	3	-
Total number of subjects requiring oral surgery other than simple exodontia	100	-
Percentage of subjects requiring oral surgery other than simple exodontia (Sample size : 2,145)	4.7	-

* In one case, a small retained portion of a deciduous root, treatment was not considered necessary. This figure has been reduced to 8 in calculating the total number of subjects requiring oral surgery.

The prevalence of congenitally missing teeth, other than third molars, among the subjects examined is shown in Table 27. It was not possible to include data on congenitally missing third molars as no radiographs were taken of the third molar region. Unlike impacted third molars where a definite diagnosis could occasionally be made from a bite-wing radiograph, to give some sort of conservative estimate of prevalence, even a rough guess of this type could not be made in the case of congenitally missing teeth. Where a radiograph showed part of the third molar region but no third molar could be seen there was no way of telling if an unerupted tooth might have been lying distal to the distal border of the film. No such limitations apply to the other teeth where the radiographic coverage permitted a reasonably firm estimate of the prevalence of congenitally missing teeth.

Other conditions recorded in this section included 17 cases of increased apical radiolucency, six cases of pathological root resorption; three cases of dilaceration, three cases of what were apparently amalgam debris inclusions in healing extraction sockets and one case of irritative hyperplasia caused by a denture.

3.16 Dental Treatment History

The comprehensive frequency distributions of subjects grouped according to their dental treatment history are shown in Tables 28 (age 15 years) and 29 (age 16 to 21 years). The somewhat questionable nature of data collected by questionnaire means in this way must be borne in mind in interpreting the significance of the figures shown. The same information for the full age span of 15 to 21 years is summarised in Figure 13. The group who reported regular care up to age 16 but not beyond is, of course, not applicable, and therefore shown as zero, for the 15 year olds. Once again a sex difference appears in these data, with once again the female superior to the male. The solid black areas of Figure 13, representing the fall off in dental care after age 16 is greater in the male than in the female, at all age groups except 21 years where small sample sizes may again be affecting the results. However, at no age group and in neither sex could this fall off be described as major. A problem exists, but not of the proportion to cause great concern.

The rather complex data of Tables 28 and 29 and Figure 13 have been simplified by pooling the original ten treatment history groups into three groups, presented in Table 30. The pooling was done in the following manner:

Group a : Subjects with regular treatment throughout life by dentist and school dental nurse or dentist alone. This group was produced by pooling the following original groups:

- 0 : Age 16-21 - Regular treatment by school dental nurse and dentist
- 4 : Age 16-21 - Regular treatment by dentist alone
- 6 : Age 15 - Regular treatment by school dental nurse and dentist
- 8 : Age 15 - Regular treatment by dentist alone.

TABLE 27 : CONGENITALLY MISSING TEETH OTHER THAN THIRD MOLARS

The prevalence among 2145 subjects of congenitally missing teeth other than third molars (inclusion of the latter was not possible due to lack of radiographs of the third molar regions). The groups according to tooth type are not mutually exclusive and the same subject may appear in more than one group. Age and sex pooled.

Condition	Number of subjects with stated condition	Number of teeth involved
Congenitally missing upper lateral incisor(s)	19	35
Congenitally missing lower premolar(s)	13	22
Congenitally missing upper premolar(s)	7	14
Congenitally missing other tooth (teeth)	7	16
Congenitally missing tooth (teeth) other than third molars (total)	33	87

TABLE 28 : TREATMENT HISTORY, AGE 15 YEARS

Frequency distribution of 15 year old subjects according to treatment history codes. The codes are defined in the footnote below. Sex specific and pooled.

Sex	Number of subjects	SUBJECTS WITH TREATMENT HISTORY CODES OF:							
		6		7		8		9	
		No.	%	No.	%	No.	%	No.	%
MALE	158	129	81.6	9	5.7	15	9.5	5	3.2
FEMALE	135	124	91.9	4	2.9	7	5.2	0	0.0
MALE AND FEMALE	293	253	86.3	13	4.4	22	7.5	5	1.7
TREATMENT HISTORY CODE	REGULAR TREATMENT BY SCHOOL DENTAL NURSE	REGULAR TREATMENT BY DENTIST UNDER GENERAL DENTAL BENEFITS	REGULAR TREATMENT BY DENTIST THROUGHOUT LIFE						
6	Yes	Yes						-	
7	Yes	No						-	
8	No	-						Yes	
9	No	-						No	

TABLE 29 : TREATMENT HISTORY, AGE 16-21 YEARS

Frequency distribution of 16 to 21 year old subjects according to treatment history codes. The codes are defined in the footnote below. Age and sex specific and pooled.

TABLE 30 : TREATMENT HISTORY, SIMPLIFIED TABULATION

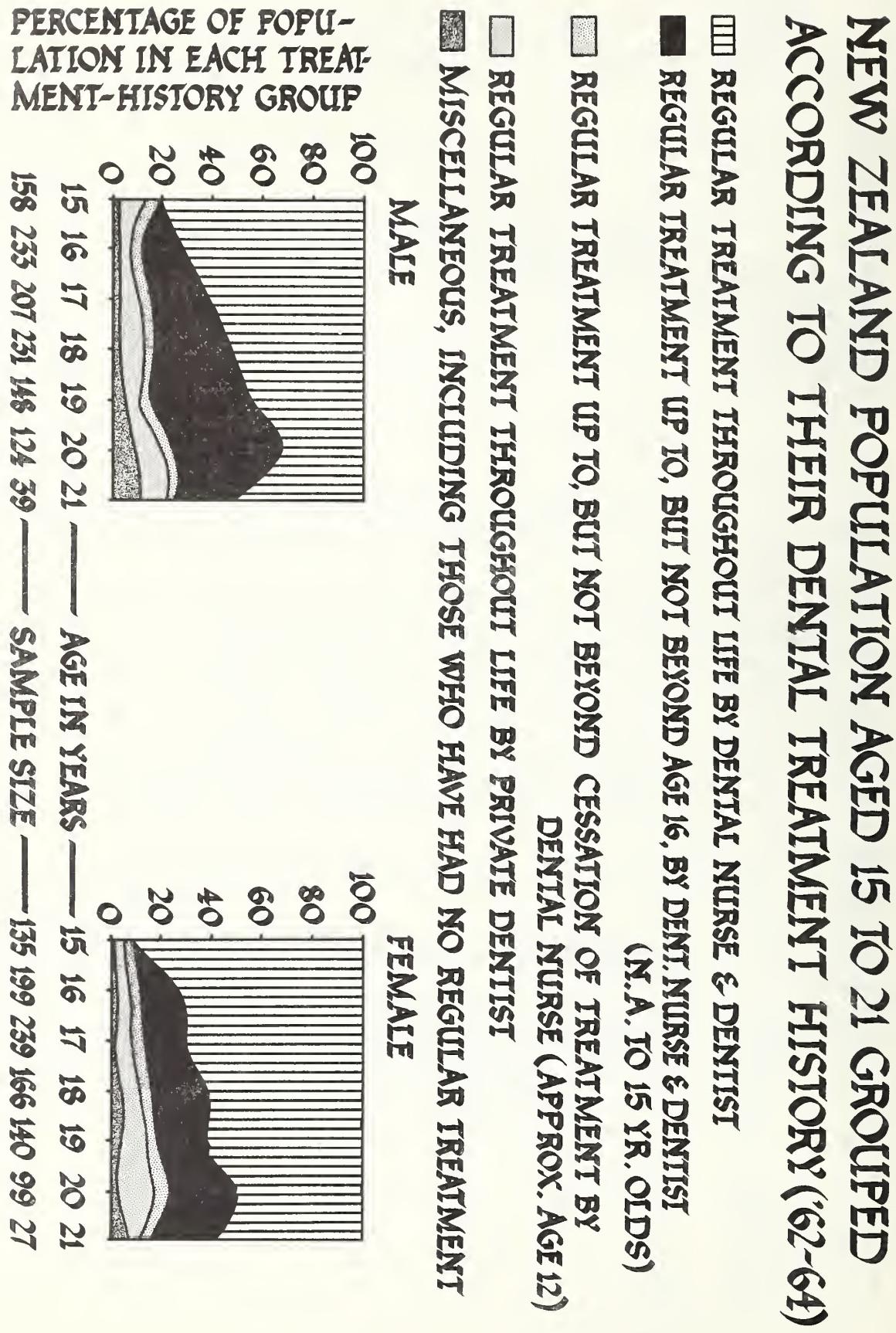
Frequency distribution of the number of subjects with regular dental treatment throughout life, regular treatment to age 16 but not beyond and a miscellaneous group. Age and sex specific and pooled.

Sex	Age in years	Number of subjects	Subjects with regular treatment throughout life, by dentist and school dental nurse or dentist alone		Subjects with regular treatment to age 16, but not beyond		Miscellaneous including those who have had no regular treatment	
			Number	Per cent	Number	Per cent	Number	Per cent
MALE	15	158	144	91.1	(N.A.) [*] 0	-	14	8.9
	16	233	177	75.9	41	17.6	15	6.4
	17	207	144	69.6	48	23.2	15	7.2
	18	231	142	61.5	74	32.0	15	6.5
	19	148	73	49.3	61	41.2	14	9.5
	20	124	55	44.4	54	43.5	15	12.1
	21	39	25	64.1	9	23.1	5	12.8
FEMALE	15-21	1140	760	66.7	287	25.2	93	8.2
	15	135	131	97.0	(N.A.) [*] 0	-	4	2.9
	16	199	157	78.9	33	16.6	9	4.5
	17	239	186	77.8	41	17.2	12	5.0
	18	166	115	69.3	40	24.1	11	6.6
	19	140	102	72.9	27	19.3	11	7.9
	20	99	63	63.6	28	28.3	8	8.1
MALE + FEMALE	21	27	17	62.9	7	25.9	3	11.1
	15-21	1005	771	76.7	176	17.5	58	5.8
	15	293	275	93.9	(N.A.) [*] 0	-	18	6.1
	16	432	334	77.3	74	17.1	24	5.6
	17	446	330	73.9	89	19.9	27	6.1
	18	397	257	64.7	114	28.7	26	6.5
	19	288	175	60.8	88	30.6	25	8.7
	20	223	118	52.9	82	36.8	23	10.3
	21	66	42	63.6	16	24.2	8	12.1
	15-21	2145	1531	71.4	463	21.6	151	7.0

* N.A. = not applicable

FIGURE 13

PERCENTAGE OF POPULATION IN EACH TREATMENT-HISTORY GROUP



Group b : Subjects with regular treatment to age 16, but not beyond. This group was identical to the original group 1 (age 16-21 - regular treatment by school dental nurse and dentist to age 16, but not beyond). This group was not applicable (=0) in 15 year olds.

Group c : Miscellaneous, including those who have had no regular treatment. This group was produced by pooling the following original groups:

- 2 : Age 16-21 - Regular treatment by school dental nurse, but not after that.
- 3 : Age 16-21 - Regular treatment by school dental nurse and after the age of 16 by a dentist, but not during the period of general dental benefits.
- 5 : Age 16-21 - No regular treatment at any time.
- 7 : Age 15 - Regular treatment by school dental nurse, but not after that.
- 9 : Age 15 - No regular treatment at any time.

In the simplified tabulation of Table 30 the sex difference in regularity of dental care as expressed by the frequency of subjects in each of the three treatment history groups can be seen. At age 19 years, for instance, 73 per cent of females reported continuing regular care, versus 49 per cent of males. This situation in the case of the female is really very encouraging as regards the adequacy of coverage of New Zealand's dental services for the young adult population; there is, however, room for improvement in the case of the male.

Another method of quantitating the regularity of dental care is to calculate the mean number of months since the reported last visit to the dentist. This has been done in Table 31 and Figure 14. The same sex difference emerges with both sexes showing a continuing increase in the length of time since the last dental appointment with increasing age - an increase of only moderate proportions in the female, but more marked in the male. The abrupt change in the male between age 20 and 21 could well be a sampling error.

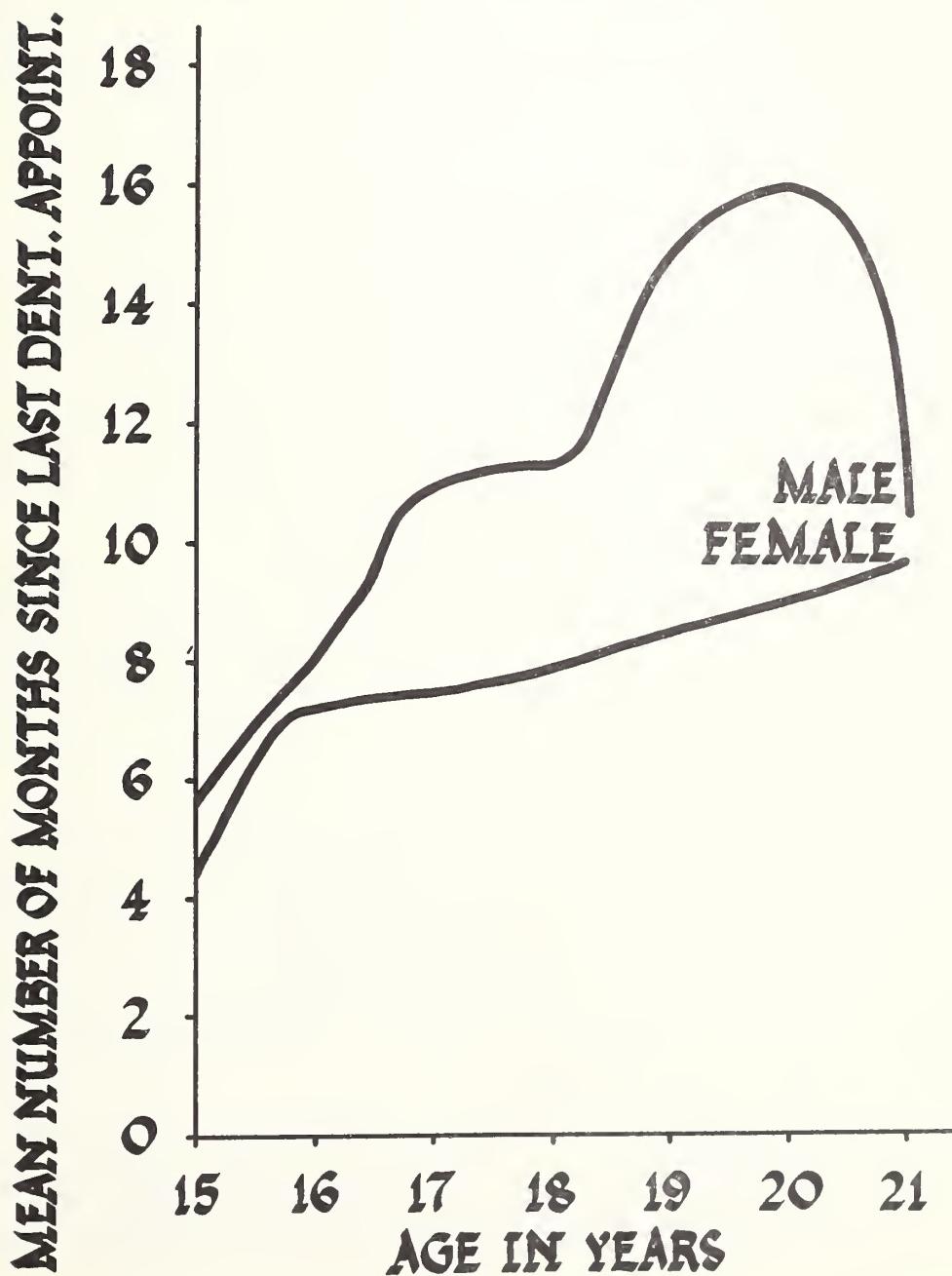
TABLE 31 : LAST DENTAL VISIT

The number of subjects who had never been to a dentist or school dental nurse, and the mean number of months since the last dental visit. The denomination for calculation of the latter was the sample size less those who had never been to a dentist. Age specific and sex specific and pooled.

Sex	Age in years	Number of subjects	Number of subjects who had never been to a dentist	Mean number of months since the last dental visit
MALE	15	158	1	5.74
	16	233	0	8.04
	17	207	1	10.89
	18	231	0	11.32
	19	148	0	15.03
	20	124	0	16.33
	21	39	1	10.74
FEMALE	15	135	0	4.36
	16	199	1	7.27
	17	239	0	7.54
	18	166	0	7.98
	19	140	0	9.14
	20	99	0	9.38
	21	27	0	9.67
MALE AND FEMALE	15	293	1	5.09
	16	432	1	7.69
	17	446	1	9.09
	18	397	0	9.92
	19	288	0	12.17
	20	223	0	13.25
	21	66	1	10.29

FIGURE 14

**REGULARITY OF DENTAL CARE IN THE
NEW ZEALAND POPULATION AGE 15 TO
21, EXPRESSED AS MEAN NUMBER OF
MONTHS SINCE THE LAST DENTAL
APPOINTMENT - 1962-64.**



SECTION 4 : DISCUSSION

A comprehensive picture has emerged, it is felt, from this survey. The prevalence of dental disease and the need for dental care in the New Zealand population aged 15 to 21 years have been established in some detail and with an adequate level of reliability.

The sampling method developed for the survey proved to be quite satisfactory both from a practical and theoretical point of view. It was in practice certainly time consuming but the effort involved was worthwhile for the sample can be regarded as adequately representative of the whole population. The total universe from which the sample was drawn would have been very close to the actual New Zealand population aged 15 to 21; or, in other words, the method approached the ideal of all sampling methods in that every New Zealander aged 15 to 21 years had an almost equal probability of selection for the sample. (There are some minor qualifications to this statement; for instance, members of religious orders did not form a part of the survey universe and, as mentioned in section 2.1, neither did farm workers, but in the latter case sampling was modified to allow for this limitation.)

The high annual attack rate of dental caries during childhood, controlled with a high level of effectiveness by the country's existing public health dental programmes, has largely abated by age 15 in the female but continues in the male with a quite marked intensity until the age of 18 or 19 years. With the personal assumption of responsibility for the financing of dental care on the sixteenth birthday, a not unexpected mild decline in the standard of dental fitness occurs in both sexes and this decline is more noticeable in the male than in the female. This is probably related to the male's continuing high annual attack rate of caries and the largely immeasurable factor of differences in social attitude toward dental health in the two sexes.

The effect of the more noticeable public health problem in the male than the female can be seen in data measuring the results of comparative dental neglect, the loss of teeth, but again this effect could not be described as gross in either sex. Rather strangely, no sex difference could be demonstrated in the prevalence of denture wearing or requirement. That improvement is occurring through the years in standards of dental health of this age group is suggested by the very encouraging comparison of denture wearing in this survey sample with that in the military recruits examined by Davies (14) in the 1950's. It is difficult to deduce a reason or reasons for this change but the following factors could well be involved: an increasing proportion of teen-age New Zealanders grew up in homes where the parents had themselves as children been patients in the School Dental Service. The health education component of this Service and, perhaps more importantly, the very existence of such a Service could well produce more dentally conscious parents, more prepared to inculcate good dental health practices in their children than the parents of a generation earlier. Secondly the increasing use of programmes of water fluoridation and fluoride tablets over the last decade or more will already be starting to show its effect in teen-agers. With optimum fluoride intake during childhood dental caries becomes a far more manageable problem and the feeling of hopelessness regarding the preservation of a natural dentition becomes far less common. The attitude "why bother, they have all got to come out anyway" is certainly becoming increasingly rare through these two main factors - a history of regular care through childhood back through more than one generation, and fluoride intake.

There is no reason to suppose that this improvement will not continue in future years. Another factor that may be operating to produce the improvement is that the change in attitude to dental care is just a small part of a general change in young people's attitudes to a great many things. One has only to consider the changes that have taken place in attitudes to clothing and fashions (on the part of both sexes), hair styling and grooming generally. Care of the teeth may be riding in on this wave of changing attitude, perhaps assisted to a considerable extent by the highly sophisticated motivational techniques of the toothpaste manufacturers in television and other advertising. The age group under consideration has been shown to be particularly susceptible to these motivational techniques.

The appearance of the early stages of periodontal disease in the age group 15 to 21, as shown by the Russell Periodontal Indices, is an omen of an increasing problem in older age groups. As dental caries is increasingly prevented and treated in childhood, and with the changing attitudes suggested above, an ever increasing proportion of the adult population will retain their natural dentition through the critical first two decades of life at which time they are reasonably well assured of a virtual life-time natural dentition as far as the caries problem is concerned. Periodontal disease, largely a disease of adulthood and a major cause of tooth loss in adults will assume greater and greater significance as a public health problem. It has long been suggested that the maintenance of a high level of oral hygiene throughout life is an effective preventive measure against periodontal disease. This hypothesis has more recently received strong support from the epidemiological work of Greene (18) and others (19), and, indeed by the sex difference findings of the present survey, where an association has been found between oral hygiene indices and periodontal indices. An increase in the magnitude of the periodontal problem should therefore be accompanied by increased emphasis on oral hygiene in dental health education. As mentioned earlier the tooth-paste manufacturers may well be achieving this purpose in a more effective manner and to a wider extent than the dental profession could ever achieve.

The more minor dental care requirements of the 15 to 21 year old New Zealand population, such as treatment for fractured anterior teeth and for symptomless pathology detected by radiography, could receive more adequate coverage than they do at present. Almost certainly this statement could be made about any population group in the world and there is no evidence to suggest that the problem is a really significant one in New Zealand. The phrase has been used several times before in this report but once again it provides the best summary of the situation - room does exist for improvement.

The question could well be asked: what significance does the present survey hold for the future course that public health dentistry should take in this country. In attempting an answer to this question, the author, as an epidemiologist, moves from observation and recorded fact to conjecture and opinion. However, this opinion is based not upon a sample of half a dozen young people who need all their teeth removed or half a dozen young people very interested in their own dental health and the preservation of their teeth, as many opinions seem to be, but on the observation over a period of many months of a reasonably representative cross-section of the young New Zealand population.

In the case of the male an improvement in dental health services could be achieved by a slight upward movement of the upper age limit for General Dental Benefits, say to age 19. Unlike the female, the male is caught in mid-caries attack on the sixteenth birthday. This simple biological difference between the sexes, almost certainly related to the earlier general maturity and earlier eruption patterns of teeth in the female, may be complicated by a sociological difference. The teen-age male may well demonstrate a higher level of "rebellion"

against school-days discipline, and regular dental care could in some cases suffer as a part of this "rebellion".

The three factors operating in the male to produce a mild but significant reduction in the standard of dental fitness during late adolescence, the continuing annual increment in dental caries, the new-found social independence, and a financial burden imposed for dental care may perhaps be overcome by the removal of one of the three. It could well be that it is the combination that is important.

The suggestion that a distinction should be made between the sexes in the provision of dental care under General Dental Benefits is certainly a novel, not to say odd, one. It is nevertheless the proposal which the epidemiological data suggest. Additional support for this distinction could perhaps be made on defence ground. It is the male only who becomes liable for National Service at age 20, and it is a sounder public health practice to continue regular maintenance care throughout life than to be faced with backlog dental treatment problems on initiation into the armed forces.

The dental "problems" in the male adolescent discussed here must be viewed in a relative fashion. The problems do exist but this is not to say that the over-all level of dental health found in this survey was low. The provision of regular care to the sixteenth birthday has produced an adolescent population with an interest in their own dental welfare, with the ravages of childhood dental disease very largely controlled, and with, in a very high proportion of cases, the prospect of the maintenance of an efficient natural masticatory system through into the third decade of life and beyond when dental caries passes from the acute phase into a very much more quiescent one.

It is unfortunate that data of the type presented here for the New Zealand population are not available from other countries. Unpublished material based on the dental examination of Australian armed forces personnel suggests that the problems posed to the New Zealand profession as regards dental care in adolescents and young adults are minimal indeed compared with those in Australia. The loss of teeth in this age group seems to be very much greater in Australia than in New Zealand. The products of New Zealand's programme of childhood incremental dental care, the late adolescents and young adults, show a very high standard of dental health despite a very high dental caries prevalence. It is a happy thought that more improvement can well be expected in future years through the increasing impact of water fluoridation, through changing attitudes toward dental health and dental health education, and, perhaps, through some quite minor changes in the nature of the dental public health programme suggested in this report.

SECTION 5 : SUMMARY

A dental survey of a random sample of the New Zealand population aged 15 to 21 was undertaken by the Division of Dental Health of the New Zealand Department of Health in the years 1962 to 1964. The primary aim of the survey was to determine the change, if any, in dental fitness following cessation of the General Dental Benefits scheme on the sixteenth birthday.

Sampling was based on places of employment, education and other day time activities. A total of 2,145 persons were included in the sample.

Each examination took approximately 15 minutes and included six radiographs for each subject. In the early phases of the survey the examinations were conducted in a mobile dental caravan, but in the later phases the equipment was set up in some convenient location within the place of employment or educational institution. A standardized examination procedure was established which included a "double-check" technique using a tape recorder.

The prevalence of dental caries was found to be very high in the sample examined. The male was still experiencing a quite high annual caries attack rate until the age of 18 or 19 years, but in the female the caries level was starting to stabilise by age 15. Both sexes showed a quite high level of dental fitness as measured by the relative magnitude of the components of the DMF teeth index, the levels being higher in the female than the male. By the use of a new index developed for this survey, the Dental Services Index, it was demonstrated that both sexes would require rather more dental treatment service to achieve complete dental fitness than that required by the children enrolled in the General Dental Benefits scheme. A sex difference again emerged with the female showing a smaller treatment requirement than the male.

By the use of Greene and Vermillion's⁽¹⁰⁾ Oral Hygiene Index the male was shown to have inferior oral hygiene compared with the female. This finding received support from the results of the questionnaire on toothbrushing habits. Males reported a markedly less frequent use of the toothbrush than females.

The Russell Periodontal Indices⁽¹¹⁾ calculated for the survey indicated a mild but significant prevalence of early periodontal disease, with higher indices in the male than the female.

Among the survey sample 5.4 per cent of subjects were either wearing or requiring full or partial denture(s). A comparison with the published work of others suggested that a definite decline in the prevalence of denture wearers among this age group is occurring.

A total of 201 subjects (9.4 per cent) had suffered a total of 262 fractured anterior teeth. A significantly greater proportion of males than females had suffered trauma of this type.

Approximately 22 per cent of subjects had enamel opacities and approximately 9 per cent of subjects had enamel hypoplasia.

The number of subjects requiring oral surgery other than simple exodontia was conservatively estimated as 4.7 per cent.

Twelve cases (0.6 per cent) of handicapping dento-facial anomalies were detected.

Thirty-three subjects were found with congenitally missing teeth other than third molars.

A sex difference was also recorded in dental treatment history. A higher proportion of females (76.7 per cent) than males (66.7 per cent) reported regular treatment throughout life, including the post-16 years where the financial responsibility for dental treatment is a personal one. The regularity of dental care as measured by the mean number of months since the last dental appointment produced a similar sex difference.

It was concluded that the overall standard of dental health in adolescents and young adults in New Zealand was high but that a relatively minor caries problem exists, in the male in particular. The sex difference is probably traceable to two factors: first, the continuing annual increment in new carious lesions in the male up to age 18 or 19 years; second, different social attitudes in the two sexes to dental health, dental home care and dental treatment.

ACKNOWLEDGEMENTS

Firstly I should wish to acknowledge the help and interest of Dr. G.H. Leslie, the Director of the Division of Dental Health at whose direction this survey was carried out.

On behalf of the Division of Dental Health and of himself, the author expresses his grateful thanks to the Royal New Zealand Dental Corps and its Director, Colonel J. Ferris Fuller, for the loan of the dental caravan and for the services of Sergeant Noel Trudgeon.

A great deal of the credit for the smooth conduct of the survey goes to my two assistants in the survey, Sergeant Noel Trudgeon and Miss Norah Kellow. At all times they carried out their duties with enthusiasm despite being called upon to work at all sorts of odd hours often under adverse conditions.

On the statistical side, Mr. S. Kuzmicich of the Department of Statistics gave the author guidance in the development of the sampling frame. The tabulation processes and the editing of this report were undertaken by the Public Health Statistician, Mr. R.J. Rose and his deputy, Mr. F.H. Foster.

A final word of acknowledgement to the employers, educational administrators and others without whose willing assistance the dental examinations of 2,145 persons could not have been carried out.

A special thanks goes to the subjects themselves, who at some inconvenience volunteered to allow their mouths to be examined and the results included in this survey.

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APPENDIX ONE - SAMPLE FRAMES

CATEGORIES 1 AND 2 - PRIVATE EMPLOYMENT AND SELF EMPLOYED

Totals of 532 males and 585 females comprising the private employment and self employed stratum of the survey were drawn from the following randomly selected firms:

1.	Philips Electrical Industries of N.Z. Ltd., Naenae, Lower Hutt. Electrical appliances manufacturers. (Included in the pilot survey.)	<u>SUBJECTS</u>	
		Male	Female
		1	21 = 22
2.	Tip Top Ice Cream Co. Wgton. Ltd., Johnsonville. Ice cream manufacturers. (Included in the pilot survey)	4	5 = 9
3.	Kempthorne Prosser and Co's N.Z. Drug Co. Wellington. Fertilizer and drug manufacturers. (Included in the pilot survey)	8	6 = 14
4.	Glaxo Laboratories (N.Z.) Ltd., Palmerston North. Drug manufacturers. (Included in the pilot survey)	6	20 = 26
5.	Barraud and Abrahams Ltd., Palmerston North. Grocery warehousemen. (Included in the pilot survey)	2	6 = 8
6.	Jacquard Hosiery Mills Ltd., Palmerston North. Hosiery manufacturers. (Included in the pilot survey)	1	3 = 4
7.	N.Z. Breweries Ltd., Palmerston North. Brewers. (Included in the pilot survey)	0	3 = 3
8.	Manawatu Canvas Co., Ltd., Palmerston North. Tent makers. (Included in the pilot survey)	1	2 = 3
9.	Premier Department Store, Palmerston North. Drapers. (Included in the pilot survey)	5	11 = 16
10.	Manawatu Daily Times Co., Ltd., Palmerston North. Newspaper publishers. (Included in the pilot survey)	5	4 = 9
11.	Hastings Milk Treatment Station, Hastings. Milk pasteurization.	1	2 = 3

			<u>SUBJECTS</u>		
			Male	Female	Total
12.	Ross, Dysart and McLean Ltd., Hastings. Garage proprietors.		3	0	= 3
13.	W. Tucker Ltd., Whakatu, Hastings. Wool scourers		2	2	= 4
14.	Magnus Motors Ltd., Napier. Garage proprietors.		2	3	= 5
15.	The East Coast Farmers' Fertilizer Co., Ltd., Awatoto, Napier. Fertilizer manufacturers.		8	5	= 13
16.	H.R. Jones and Co., Ltd., Feilding. Building and joinery contractors.		2	1	= 3
17.	Manawatu Joinery Co. Ltd., Palmerston North. Joinery manufacturers.		9	0	= 9
18.	John Cobbe and Co., Feilding. Drapers, etc.		2	4	= 6
19.	T. and J. McIlwaine Ltd., Marton. Builders, sawmillers, etc.		4	1	= 5
20.	H.R. Kemp and Sons, Ltd., Hawera. Garage proprietors		7	1	= 8
21.	Arthur Brown Construction Co. Ltd., Hawera. Builders and constructors.		1	0	= 1
22.	P.H. Harding and Sons, Ltd., Kaponga. Furnishers and furniture manufacturers.		3	5	= 8
23.	McCutcheon and Co. (Taranaki) Ltd., Stratford. Wholesale fruit and produce merchants.		0	6	= 6
24.	R.J. Burkitt Ltd., New Plymouth. Motor and general engineers		5	2	= 7
25.	C.S. Lucas and Co. Ltd., Stratford. Drapers, furnishers.		1	7	= 8
26.	Southward Engineering Co. Ltd., Seaview, Lower Hutt. Manufacturing engineers.		11	0	= 11
27.	Hutt Printing and Publishing Works Ltd., Lower Hutt. Newspaper proprietors.		0	1	= 1

			<u>SUBJECTS</u>		
			Male	Female	Total
28.	V.A. Pool and Co. Ltd., Lower Hutt. Manufacturers of canned goods and condiments.		0	1	= 1
29.	Pinnock (N.Z.) Ltd., Naenae, Lower Hutt. Manufacturers and distributors of sewing machines.	1	0	= 1	
30.	J.A. Hazelwood and Co. Ltd., Upper Hutt. Departmental store.	6	10	= 16	
31.	Tom Croft Motors Ltd., Upper Hutt. Automobile dealers.	3	0	= 3	
32.	General Motors New Zealand Ltd., Petone. Motor vehicle importers and assemblers, etc.	33	12	= 45	
33.	Magnet Bakeries (Wellington) Ltd., Karori, Wellington. Bread and cake manufacturers.	3	2	= 5	
34.	The Carrara Ceiling Co., Ltd., Wellington. Fibrous plaster manufacturers.	0	1	= 1	
35.	Wiggins Teape and Alex. Pirie (Export) Ltd., Wellington. Paper makers.	1	2	= 3	
36.	S.W. Peterson and Co. Ltd., Wellington. Manufacturing chemists.	2	3	= 5	
37.	T. and W. Young Ltd., Wellington. Wine and spirit merchants, etc.	1	1	= 2	
38.	Gilbert and Barker Mfg. Co.(Aust) Pty. Ltd., Wellington. Manufacturers of petrol dispensing equipment.	0	3	= 3	
39.	The National Mutual Life Association of Australasia Ltd., Wellington. Life assurance.	14	46	= 60	
40.	Cable-Price Corporation Ltd., Wellington. Engineering sales and service.	3	5	= 8	
41.	Morris and Ward Ltd. (Clyde Engineering), Rotorua. Engineers, sales and service	5	0	= 5	
42.	Couriers (NZ) Ltd., Te Awamutu. Printers and publishers.	5	0	= 5	
43.	Waikato Sheet Metals Ltd., Frankton. Sheet metal workers.	3	2	= 5	

			<u>SUBJECTS</u>		
			Male	Female	Total
44.	Plastic Products Ltd., Hamilton. Plastic moulders.		17	12	= 29
45.	Bristol-Myers Co. Pty. Ltd., Auckland. Manufacturing chemists.		0	3	= 3
46.	H.J. Ryan Ltd., Mt. Roskill, Auckland. Manufacturing and precision engineers.		9	0	= 9
47.	Poultrymen's Co-operative Ltd., Auckland. Egg distributors, etc.		2	0	= 2
48.	Lynn Laces (branch of Felt and Textiles of N.Z. Ltd.,) Auckland. Lace manufacturers, etc.		11	4	= 15
49.	Robert Stevens Ltd., Auckland. Automobile dealers.		5	0	= 5
50.	Jas. Robertson Ltd., Dargaville. Plumbers, hardware merchants		3	1	= 4
51.	Plastic Research and Development N.Z. Ltd., Auckland. Plastic goods manufacturers.		3	10	= 13
52.	Mono (N.Z.) Ltd., Auckland. Paper converters.		7	8	= 15
53.	Sinton Engineering and Autos Ltd., Auckland. Trailer manufacturers, body builders, engineers.		2	0	= 2
54.	W.G. Allen and Co. Ltd., Auckland. Commercial stationers and office furnishers.		1	3	= 4
55.	W.A. Stroud Ltd., Auckland. Leather goods manufacturers		4	2	= 6
56.	Cranwell Publishing Co., Ltd., Auckland. Publishers		0	1	= 1
57.	N. Cole Ltd., Auckland. Builders, shop fitters		2	1	= 3
58.	Refrigeration Engineering Co. Ltd., Auckland. Refrigeration engineers		2	2	= 4

			<u>SUBJECTS</u>		
			Male	Female	Total
59.	Smith and Brown Ltd., Auckland. Furniture manufacturers, retailers.		9	13	= 22
60.	Caxton Printing Works Ltd., Auckland. Paper goods manufacturers.		8	17	= 25
61.	The Fletcher Construction Co. Ltd., Penrose, Auckland. Building and civil engineers.		2	4	= 6
62.	New Zealand Sugar Co. Ltd., Auckland. Sugar refining.		11	0	= 11
63.	Victoria Knitwear Ltd., Auckland. Knitwear manufacturers.		0	8	= 8
64.	E.L. Riley Ltd., Auckland. Clothing manufacturers		4	11	= 15
65.	Allied Industries Ltd., Auckland. Radio and T.V. manufacturers.		19	16	= 35
66.	Ultimate-Ekco (N.Z.) Co. Ltd., Auckland. Electrical appliances manufacturers.		17	7	= 24
67.	R.H. Exton and Co. Auckland. Women's outerwear manufacturers.		0	8	= 8
68.	Smith and Caughey Ltd., Auckland. Department store.		7	25	= 32
69.	New Zealand Drycleaners and Dyers Ltd., Auckland. Drycleaners and dyers.		2	8	= 10
70.	The Wrigley Co. (N.Z.) Ltd., Auckland. Chewing gum manufacturers.		1	3	= 4
71.	White Cliffs Sawmilling Co. Ltd., Auckland. Timber and joinery merchants.		8	0	= 8
72.	The South British Insurance Co. Ltd., Auckland. Fire, marine, accident insurance.		20	18	= 38
73.	Harris Langton Ltd., Auckland. Clothing manufacturers.		9	18	= 27
74.	P.C. Blenkarne Ltd., Auckland. Wholesale electrical merchants.		4	6	= 10

			<u>SUBJECTS</u>		
			Male	Female	Total
75.	Swinton and Oates Ltd., Auckland. Women's shoe manufacturers.		6	9	= 15
76.	A.H. Turnbull and Co. Ltd., Christchurch. General merchants, grain and seed merchants.		2	2	= 4
77.	Perfection Ice Cream Co. Ltd., Christchurch. Ice cream manufacturers.		3	7	= 10
78.	Hardie and Thomson Ltd., Christchurch. Timber and joinery merchants.		4	1	= 5
79.	Blackwell Motors Ltd., Christchurch. Motor dealers.		23	5	= 28
80.	E.W. Pidgeon and Co. Ltd., Christchurch. Rubber merchants.		0	5	= 5
81.	Thos. L. Jones and Son Ltd., Christchurch. Electrical engineers.		15	0	= 15
82.	R.L. Sparrow Ltd., Christchurch. Joinery manufacturers.		6	0	= 6
83.	Ernest Adams Ltd., Christchurch. Cake manufacturers.		3	10	= 13
84.	Pyne, Gould, Guiness Ltd., Christchurch. Stock and station agents.		14	22	= 36
85.	Millers Worsted and Woollen Mills Ltd., Christchurch. Manufacturers of woollen and worsted materials.		7	7	= 14
86.	Canterbury (N.Z.) Malting Co. Ltd., Christchurch. Maltsters.		4	2	= 6
87.	A.J. White Ltd., Christchurch. Furniture manufacturers.		5	1	= 6
88.	Amalgamated Batteries Ltd., Christchurch. Storage battery manufacturers.		2	2	= 4
89.	Marlborough Lingerie Ltd., Blenheim. Manufacturers of ladies' lingerie		1	53	= 54
90.	B.J. Hipkins Ltd., Blenheim. Motor vehicle dealers.		6	0	= 6

			<u>SUBJECTS</u>		
			Male	Female	Total
91.	Horwell, Osborn, McBeath Ltd., Timaru. Motor dealers.		5	0	= 5
92.	W. Taylor & Co. Ltd., Saltwater Creek, Timaru. Commission woolscourers.		3	0	= 3
93.	Atlas Timber Co. (Dn.) Ltd., Dunedin. Timber and wallboard merchants.		2	0	= 2
94.	N.Z. Tablet Printing and Publishing Co.Ltd., Dunedin. Printers and publishers.		5	1	= 6
95.	Hogg and Co. Ltd., Dunedin. Timber merchants.		6	4	= 10
96.	Hallenstein Bros. Ltd., Dunedin. Manufacturers and retailers of men's wear.		7	6	= 13
97.	City Motors Service Ltd., Dunedin. Motor repairs and sales.		5	0	= 5
98.	Charles Begg and Co. Ltd., Dunedin. Musical and electrical warehousemen.		4	2	= 6
99.	H. and J. Smith Ltd., Invercargill. Department store.		3	18	= 21
100.	H.E. Melhop Ltd., Invercargill. Engineers and garage proprietors.		12	4	= 16
101.	A. Russell and Co. Ltd., Invercargill. Garage proprietors.		11	4	= 15
102.	The Southland Times Co. Ltd., Invercargill. Newspaper proprietors.		5	2	= 7

The following firms, although selected for inclusion in the survey by the randomizing procedure, were, in fact, not included for the reasons stated:

No employees under 22 years of age

Solway Products Ltd., Auckland. Lacquer manufacturers.	Industrial Electrical Heating Co. Christchurch. Bread baking oven manufacturers.
Wanganui Furniture Manufacturing Co.Ltd., Wanganui. Wholesale and retail furniture manufact.	New Zealand Industries Ltd., Auckland. Manufacturers of plastic products.

C.O. Products Ltd., Wellington. Polish manufacturers.	F.R. Wilkins Ltd., Auckland. Footwear manufacturers.
H.C. Barker and Co. Ltd., Auckland. Millinery manufacturers.	Vesta Battery Co. Ltd., Wellington. Storage battery manufacturers.
A. and A.F. Reay Ltd., Christchurch. Upholsterers.	Classic Manufacturing Co. Ltd., Auckland. Clothing manufacturers.
Groveburn Sawmilling Co. Ltd., Invercargill. Timber millers.	G. Herring (N.Z.) Ltd., Trentham. Button manufacturers.
Wilton Motor Body Co. Ltd., Auckland. Coach and motor body builders.	R.G. Robinson Ltd., Christchurch. Grain and produce merchants.

Firms gone into liquidation:

Auto Tools Ltd., Hamilton. Automotive and precision engineers.	The Flaxbourne Lime Ltd., Blenheim. Agricultural lime manufacturers.
Easton Products Ltd., Auckland. Manufacturing chemists.	

Required sample size reached before firm visited:

Smith and Smith Ltd., Wellington. Paint, oil, etc. merchants.	Port Line Ltd., Wellington. Shipping.
The Wellington Publishing Co. Ltd., Wellington. Newspaper proprietors.	Union Steam Ship Co. of N.Z. Ltd., Wellington. Shipowners.

Management declined to participate:

One organization, in Dunedin, declined to participate.

CATEGORY 3 : GOVERNMENT DEPARTMENTS AND LOCAL AUTHORITIES

Totals of 56 males and 74 females comprising the government departments and local authorities stratum of the survey were drawn from the following randomly selected departments and authorities:

	<u>SUBJECTS</u>		
	Male	Female	Total
1. Department of Internal Affairs, Wellington. (included in the pilot survey)	2	11	= 13
2. N.Z. Forestry Service, Wellington. (included in the pilot survey)	7	1	= 8
3. Herd Street Post Office, Wellington. (included in the pilot survey)	11	13	= 24

		<u>SUBJECTS</u>		
		Male	Female	Total
4.	Wellington Harbour Board, Wellington. (included in the pilot survey)	36	0	= 36
5.	Inland Revenue Department, Hamilton.	0	49	= 49

The following two departments, although selected for inclusion in the survey by the randomizing procedure, were, in fact, not included because the required sample size had been reached before the departments were visited.

Department of Labour, Christchurch.	Customs Department, Auckland.
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CATEGORY 4 : ARMED FORCES

Totals of 20 males and 3 females comprising the armed forces stratum of the survey were drawn from the following randomly selected military establishment :

Linton Military Camp, Linton.	20	3	= 23
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CATEGORY 5 : EDUCATIONAL

Totals of 336 males and 338 females comprising the educational stratum of the survey were drawn from the following institutions falling into five sub-categories:

SUB-CATEGORY A - SECONDARY SCHOOLS.

1.	Feilding Agricultural High School, Feilding.	87	28	= 115
2.	Wellington Boys' College, Wellington.	83	0	= 83
3.	Wellington East Girls' College, Wellington.	0	88	= 88
4.	Dannevirke High School, Dannevirke.	18	18	= 36
5.	King Edward Technical College, Dunedin.	27	34	= 61

SUB-CATEGORY B - UNIVERSITIES.

1.	Victoria University of Wellington, Wellington.	92	40	= 132
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SUB-CATEGORY C - TEACHERS' COLLEGES.

1.	Palmerston North Teachers' College, Palmerston North.	11	42	= 53
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		<u>SUBJECTS</u>		
		Male	Female	Total
SUB-CATEGORY D - NURSE TRAINING HOSPITALS				
1.	Karitane Hospital, Wellington.	0	11	= 11
2.	Napier Hospital, Napier.	0	34	= 34
3.	New Plymouth Hospital, New Plymouth.	0	43	= 43
SUB-CATEGORY E - OTHER EDUCATIONAL INSTITUTIONS				
1.	The Police Training School, Trentham. (included in the pilot survey)	18	0	= 18

CATEGORY 6 : FARMING

Totals of 196 males and 0 females comprising the farming stratum of the survey were drawn from the following selected rural institutions.

As discussed in the text of this paper, these individuals provided a compromise sample reasonably representative of the rural, and therefore the farming, population.

1.	Flock House (Department of Agriculture), Bulls.	43	0	= 43
2.	Woodsmen Training School, (N.Z. Forestry Service), Kaingaroa State Forest.	91	0	= 91
3.	Woodsmen Training School, (N.Z. Forestry Service), Golden Downs State Forest.	62	0	= 62

CATEGORY 7 : DOMESTIC AND UNEMPLOYED

Totals of 0 males and 5 females comprising the domestic and unemployed stratum of the survey were drawn from the following Plunket Rooms:

1.	Cannons Creek Plunket Rooms, Cannons Creek.	0	3	= 3
2.	Newtown Plunket Rooms, Newtown.	0	2	= 2
3.	Wainuiomata Plunket Rooms, Wainuiomata.	0	0	= 0

APPENDIX TWO : TERRITORIAL LOCAL AUTHORITY CODES

Based upon the subject's residential address, a territorial local authority code was punched in columns 10 to 12 of the punch card. These codes are given in the schedule below:

<u>COUNTY</u>	<u>CODE</u>	<u>COUNTY</u>	<u>CODE</u>
Mangonui	000	Waipukurau	037
Whangaroa	001	Patangata	038
Hokianga	002	Dannevirke	039
Bay of Islands	003	Woodville	040
Whangarei	004	Clifton	041
Hobson	005	Taranaki	042
Otamatea	006	Inglewood	043
Rodney	007	Egmont	044
Waitemata	008	Stratford	045
Great Barrier Island	009	Eltham	046
Manukau	010	Waimate West	047
Franklin	011	Hawera	048
Raglan	012	Patea	049
Waikato	013	Waimarino	050
Waipa	014	Waitotara	051
Otorohanga	015	Wanganui	052
Waitomo	016	Rangitikei	053
Taumarunui	017	Kiwitea	054
Coromandel	018	Pohangina	055
Thames	019	Orona	056
Hauraki Plains	020	Manawatu	057
Ohinemuri	021	Kairanga	058
Piako	022	Horowhenua	059
Matamata	023	Hutt	060
Tauranga	024	Makara	061
Rotorua	025	Pahiatua	062
Taupo	026	Akitio	063
Whakatane	027	Eketahuna	064
Opotiki	028	Mauriceville	065
Matakaoa	029	Masterton	066
Waiapu	030	Wairarapa South	067
Uawa	031	Featherston	068
Waikohu	032	Marlborough	069
Cook	033	Awatere	070
Wairoa	034	Kaikoura	071
Hawke's Bay	035	Amuri	072
Waipawa	036	Cheviot	073

<u>COUNTY</u>	<u>CODE</u>	<u>COUNTY</u>	<u>CODE</u>
Waimea	074	Springs	097
Golden Bay	075	Ellesmere	098
Buller	076	Selwyn	099
Murchison	077	Ashburton	100
Inangahua	078	Geraldine	101
Grey	079	Levels	102
Westland	080	MacKenzie	103
Waipara	081	Waimate	104
Komai	082	Waitaki	105
Ashley	083	Waihemo	106
Rangiora	084	Waikouaiti	107
Eyre	085	Peninsular	108
Oxford	086	Taieri	109
Tawera	087	Bruce	110
Malvern	088	Clutha	111
Paparua	089	Tuapeka	112
Waimairi	090	Maniototo	113
Heathcote	091	Vincent	114
Halswell	092	Lake	115
Mount Herbert	093	Southland	116
Akaroa	094	Wallace	117
Chatham Islands	095	Stewart Island	118
Wairewa	096		

<u>BOROUGHS</u>	<u>CODE</u>	<u>BOROUGHS</u>	<u>CODE</u>
Kaitaia	200	Mount Roskill	217
Kaikohe	201	One Tree Hill	218
Whangarei	202	Onehunga	219
Dargaville	203	Ellerslie	220
Helensville	204	Mount Wellington	221
East Coast Bays	205	Howick	222
Birkenhead	206	Otahuahu	223
Northcote	207	Papatoetoe	224
Takapuna (City)	208	Manurewa	225
Devonport	209	Papakura	226
Henderson	210	Pukekohe	227
Glen Eden	211	Waiuku	228
New Lynn	212	Tuakau	229
Auckland (City)	213	Huntly	230
Newmarket	214	Ngaruawahia	231
Mount Albert	215	Hamilton (City)	232
Mt. Eden	216	Cambridge	233

<u>BOROUGH</u>	<u>CODE</u>	<u>BOROUGH</u>	<u>CODE</u>
Te Awamutu	234	Feilding	276
Otorohanga	235	Foxton	277
Te Kuiti	236	Palmerston North (City)	278
Taumarunui	237	Shannon	279
Thames	238	Levin	280
Paeroa	239	Otaki	281
Waihi	240	Upper Hutt	282
Te Aroha	241	Lower Hutt (City)	283
Morrinsville	242	Petone	284
Matamata	243	Eastbourne	285
Putaruru	244	Porirua	286
Mount Maunganui	245	Tawa	287
Tauranga	246	Wellington (City)	288
Te Puke	247	Pahiatua	289
Rotorua (City)	248	Eketahuna	290
Murupara	249	Masterton	291
Taupo	250	Carterton	292
Whakatane	251	Greytown	293
Kawerau	252	Featherston	294
Opotiki	253	Martinborough	295
Gisborne (City)	254	Picton	296
Wairoa	255	Blenheim	297
Napier (City)	256	Nelson (City)	298
Taradale	257	Richmond	299
Hastings (City)	258	Motueka	300
Havelock North	259	Westport	301
Waipawa	260	Runanga	302
Waipukurau	261	Greymouth	303
Dannevirke	262	Brunner	304
Woodville	263	Kumara	305
Waitara	264	Hokitika	306
New Plymouth (City)	265	Ross	307
Inglewood	266	Rangiora	308
Stratford	267	Kaiapoi	309
Eltham	268	Riccarton	310
Hawera	269	Christchurch (City)	311
Patea	270	Lyttelton	312
Ohakune	271	Ashburton	313
Raetihi	272	Geraldine	314
Wanganui (City)	273	Temuka	315
Taihape	274	Timaru (City)	316
Marton	275	Waimate	317

<u>BOROUGH</u>	<u>CODE</u>	<u>BOROUGH</u>	<u>CODE</u>
Oamaru	318	Lawrence	332
Hampden	319	Roxburgh	333
Palmerston (South)	320	Naseby	334
Waikouaiti	321	Alexandra	335
Port Chalmers	322	Cromwell	336
West Harbour	323	Arrowtown	337
Dunedin (City)	324	Queenstown	338
St. Kilda	325	Gore	339
Green Island	326	Mataura	340
Mosgiel	327	Winton	341
Milton	328	Invercargill (City)	342
Kaitangata	329	Bluff	343
Balclutha	330	Riverton	344
Tapanui	331		

<u>INDEPENDENT TOWN DISTRICT</u>	<u>CODE</u>	<u>INDEPENDENT TOWN DISTRICT</u>	<u>CODE</u>
Kawakawa	345	Manunui	352
Hikurangi	346	Mangaweka	353
Kamo	347	Hunterville	354
Warkworth	348	Wyndham	355
Ohura	349	Lumsden	356
Manaia	350	Nightcaps	357
Waverley	351	Otautau	358

<u>DEPENDENT TOWN DISTRICT</u>	<u>CODE</u>	<u>DEPENDENT TOWN DISTRICT</u>	<u>CODE</u>
Kohukohu (Hokianga)	359	Patutahi (Cook)	364
Russell (Bay of Islands)	360	Kaponga (Eltham)	365
Te Kauwhata (Waikato)	361	Normanby (Hawera)	366
Ohaupo (Waipa)	362	Edendale (Southland)	367
Kihikihi (Waipa)	363		

APPENDIX THREE : OCCUPATION CODES

The following schedule of occupation codes is an abbreviated form of the document, Census 258, issued by the New Zealand Department of Statistics. Codes B1 to B6 inclusive, however, do not appear in the original document but were included for the purposes of this survey. The code corresponding to each subject's occupation was punched in columns 13 and 14 of the punch card.

N.o.d. = Not otherwise defined
 N.e.i. = Not elsewhere included
 N.e.c. = Not elsewhere classified

DIVISION 0: PROFESSIONAL, TECHNICAL, AND RELATED WORKERS

- 00 Architects, engineers, surveyors
- 01 Chemists, physicists, geologists, and other physical scientists
- 02 Biologists, veterinarians, agronomists, and related scientists
- 03 Physicians, surgeons, and dentists
- 04 Nurses and midwives
- 05 Professional medical workers n.e.c., and medical technicians
- 06 Teachers
- 07 Clergy and related members of religious orders
- 08 Jurists
- 09 Artists, writers, and related workers
- 0A Draughtsmen, and science and engineering technicians, n.e.c.
- 0B Other professional technical and related workers

DIVISION 1: ADMINISTRATIVE, EXECUTIVE AND MANAGERIAL WORKERS

- 10 Administrative, and executive officials: government
- 11 Directors, managers, and working proprietors (not including proprietors on own account in wholesale and retail trade)

DIVISION 2: CLERICAL WORKERS

- 20 Bookkeepers and cashiers
- 21 Stenographers and typists
- 22 Other clerical workers
- 30 Working proprietors, wholesale and retail trade
- 31 Insurance and real estate salesmen, salesmen of securities and services, and auctioneers
- 32 Commercial travellers and manufacturing agents
- 33 Salesmen, shop assistants, and related workers

DIVISION 4: FARMERS, FISHERMEN, HUNTERS, LOGGERS, AND RELATED WORKERS

- 40 Farmers and farm managers
- 41 Farm workers n.e.c.
- 42 Hunters and related workers
- 43 Fishermen and related workers
- 44 Loggers and other forestry workers

DIVISION 5: MINERS, QUARRYMEN, AND RELATED WORKERS

- 50 Miners and quarrymen
- 51 Well drillers and related workers
- 52 Mineral treaters
- 59 Miners, quarrymen, and related workers, n.e.i.

DIVISION 6: WORKERS IN TRANSPORT AND COMMUNICATIONS OCCUPATIONS

- 60 Deck officers, engineer officers and pilots (ship)
- 61 Deck and engine room ratings, ship and barge crews, and boatmen
- 62 Aircraft pilots, navigators and flight engineers (not Air Force)
- 63 Drivers and firemen (railway engines)
- 64 Drivers, road transport
- 65 Guards and brakemen - railways
- 66 Inspectors, supervisors, traffic controllers and despatchers - transport
- 67 Telephone, telegraph, and related communication operators
- 68 Postmen and messengers
- 69 Workers in transport and communications occupations, n.e.c.

DIVISIONS 7 and 8: CRAFTSMEN, PRODUCTION PROCESS WORKERS AND LABOURERS NOT ELSEWHERE CLASSIFIED

- 70 Spinners, weavers, knitters, dyers, and related workers
- 71 Tailors, cutters, furriers and related workers
- 72 Leather cutters, lasters, and sewers (except gloves and garments) and related workers
- 73 Furnacemen, rollers, drawers, moulders, and related metal making and treating workers
- 74 Precision instrument makers, watchmakers, jewellers, and related workers
- 75 Tool makers, machinists, plumbers, welders, platers and related workers
- 76 Electricians and related electrical and electronic workers
- 77 Carpenters, joiners, cabinet makers, coopers and related workers
- 78 Painters and paperhangers
- 79 Bricklayers, plasterers, and construction workers, n.e.c.
- 80 Compositors, pressmen, engravers, bookbinders, and related workers
- 81 Potters, kilnsmen, glass and clay formers, and related workers
- 82 Millers, bakers, brewmasters, and related food and beverage workers
- 83 Chemical and related process workers
- 84 Tobacco preparers and tobacco product makers
- 85 Craftsmen and production process workers, n.e.c.
- 86 Packers, labellers, and related workers
- 87 Stationary engine, excavating and lifting equipment operators, and related workers
- 88 Waterside workers and related freight handlers
- 89 Labourers, n.e.c.

DIVISION 9 : SERVICE, SPORT, AND RECREATION WORKERS

- 90 Firefighters, policemen, guards, and related workers
- 91 Housekeepers, cooks, maids, and related workers
- 92 Waiters, bartenders, and related workers
- 93 Building caretakers, cleaners and related workers
- 94 Barbers, hairdressers, beauticians and related workers
- 95 Launderers, dry-cleaners and pressers
- 96 Athletes, sportsmen and related workers
- 97 Photographers and related camera operators
- 98 Embalmers and undertakers
- 99 Service, sport and recreation workers, n.e.c.

DIVISION A: WORKERS NOT CLASSIFIABLE BY OCCUPATION

- A1 New workers seeking employment
- A2 Workers reporting occupations unidentifiable or inadequately described
- A3 Workers not reporting any occupation

DIVISION B: ARMED FORCES (AND STUDENTS)

- B0 Armed forces
- B1 Student, school
- B2 Student, university
- B3 Student, teachers' college
- B4 Student, nursing
- B5 Student, n.e.c.
- B6 Housewives

(NOTE: In assigning occupation codes to the subjects in this survey, the original Department of Statistics document (Census 258) was used. In this document a four digit code is used and there are a great many sub-headings under each of the main headings given above. These sub-headings, by defining the main headings more fully, allowed a high degree of precision in assigning the two digit code.)

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